Sri Shridevi Charitable Trust (R.)
SHRIDEVI INSTITUTE OF ENGINEERING & TECHNOLOGY
Sira Road, Tumkur - 572 106, Karnataka, India.
Phone: 0816 - 2212629 | Principal: 0816 - 2212627, 9686114899 | Telefax: 0816 - 2212628
Email: info@shrideviengineering.org, principal@shrideviengineering.org | Website: www.shrideviengineering.org
(Approved by AICTE, New Delhi, Recognised by Govt. of Karnataka and Affiliated to Visvesvaraya Technological University, Belagavi)
ESTD:2002

Criteria 1.1

Curriculum Planning and Implementation

Syllabus Copy (Civil)

2018 – 2023

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TUMKUR - 572106.

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Criteria 1.1

Curriculum Planning and Implementation

Syllabus Copy (Civil)

2018 scheme

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TUMKUR - 572106.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

Scheme of Teaching and Examination and Syllabus
B.E. CIVIL ENGINEERING
(Effective from Academic year 2018-19)

General Notes:

1. Question Paper Pattern for Theory Courses:
   - The question paper will have TEN questions, Each full question carries 20 marks, There will be two full questions (with a maximum of four subquestions) from each module.Each full question will have sub questions covering all the topicsunder a module.
   - Students will have to answer 5 full questions, selecting one fullquestion from each module.
2. The teaching learning process should be as per the Choice Based CreditSystem
3. All Civil Engineering Departments should have a "CIVIL ENGINEERINGMUSEUM" with collections like models,charts, material samples, fixtures and fittings etc. which assist effectiveteaching learning process.
4. The teaching learning process may be planned to develop capabilities,competencies and skills required for career development based on coursebeginning and course end surveys.
5. Course objectives, course outcomes and RBT levels given under eachcourse in the syllabus are indicative/suggestive. The facultycan set them appropriately according to their lesson/ course plan.
6. The course coordinators/teachers/instructors are informed to deliberatein the faculty meeting with module coordinator, program coordinatoralong with the stake holders to develop the respective lesson/ courseplans.
7. The department advisory board may make suitable changes to thecourse objectives, course outcomes according totheir finalized course plans.
8. The faculty should complement the teaching with case studies and fieldvisits wherever required.
9. At least one faculty development program to be conducted to complimentteaching learning process by the department in a year

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture L	Tutorial T	Practical/ Drawing P	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	18MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CV32	Strength of Materials	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV33	Fluid Mechanics	Civil Engg.	3	0	--	03	40	60	100	3
4	PCC	18CV34	Building Materials and Construction	Civil Engg.	3	0	--	03	40	60	100	3
5	PCC	18CV35	Basic Surveying	Civil Engg.	3	0	--	03	40	60	100	3
6	PCC	18CV36	Engineering Geology	Geology	3	0	--	03	40	60	100	3
7	PCC	18CVL37	Computer Aided Building Planning & Drawing	Civil Engg.	--	2	2	03	40	60	100	2
8	PCC	18CVL38	Building Materials Testing Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18KVK39	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
			OR									
		18KAK39	Aadalitha Kannada (Kannada for Administration)									
			OR									
		18CPC39	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	17 OR 18	08 OR 10	04	24 OR 26	420 OR 360	480 OR 540	900	24

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course. .

18KVK39Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F

grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE. (b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs
Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
AICTE Activity Points to be earned by students admitted to BE/B. Tech/B. Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT41	Complex Analysis, Probability And Statistical Methods	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CV42	Analysis of Determinate Structures	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV43	Applied Hydraulics	Civil Engg.	3	0	--	03	40	60	100	3
4	PCC	18CV44	Concrete Technology	Civil Engg.	3	0	--	03	40	60	100	3
5	PCC	18CV45	Advanced Surveying	Civil Engg.	3	0	--	03	40	60	100	3
6	PCC	18CV46	Water Supply & Treatment Engineering	Civil Engg.	3	0	--	03	40	60	100	3
7	PCC	18CVL47	Engineering Geology Laboratory	Geology	--	2	2	03	40	60	100	2
8	PCC	18CVL48	Fluid Mechanics and Hydraulic Machines Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for Communication)/	HSMC	--	2	--	--	100	--	100	1
			OR									
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
			OR									
		18CPC39/49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	17 OR 18	08 OR 10	04	24 OR 26	420 OR 360	480 OR 540	900	24

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39/49Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39/49Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

Sl. No	Course	Course code	Course Title	Teaching Department	L	T	P	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
10	NCMC	18MATDIP41	Additional Mathematics - II	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

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(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs
Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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Programme: CIVIL ENGINEERING

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMC	18CV51	Construction Management & Entrepreneurship	Civil Engg.	2	2	--	03	40	60	100	3
2	PCC	18CV52	Analysis of Indeterminate Structures	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV53	Design of RC Structural Elements	Civil Engg.	3	2	--	03	40	60	100	4
4	PCC	18CV54	Basic Geotechnical Engineering	Civil Engg.	3	--	--	03	40	60	100	3
5	PCC	18CV55	Municipal Wastewater Engineering	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CV56	Highway Engineering	Civil Engg.	3	--	--	03	40	60	100	3
7	PCC	18CVL57	Surveying Practice	Civil Engg.	--	2	2	03	40	60	100	2
8	PCC	18CVL58	Concrete and Highway Materials Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/Environmental [Paper setting Board: Civil Engineering]	1	--	--	02	40	60	100	1
				TOTAL	**18**	**10**	**04**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CIVIL ENGINEERING
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(Effective from the academic year 2018 – 19)

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18CV61	Design of Steel Structural Elements	Civil Engg.	3	2	--	03	40	60	100	4
2	PCC	18CV62	Applied Geotechnical Engineering	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV63	Hydrology and Irrigation Engineering	Civil Engg.	3	2	--	03	40	60	100	4
4	PEC	18CV64X	Professional Elective -1	Civil Engg.	3	--	--	03	40	60	100	3
5	OEC	18CV65X	Open Elective -A	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CVL66	Software Application Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
7	PCC	18CVL67	Environmental Engineering Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
8	EP	18CVEP68	Extensive Survey project	Civil Engg.	--	2	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
				TOTAL	15	12	06	24	320	480	800	24

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1

Course code under18CV64X	
18CV641	Matrix Method of Structural Analysis

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18CV642	Solid Waste Management
18CV643	Alternate Building Materials
18CV644	Ground Improvement Techniques
18CV645	Railway, Harbours, Tunnelling & Airports
Open Elective -A	
Course code under18CV65X	
18CV651	Remote Sensing & GIS
18CV652	Traffic Engineering
18CV653	Occupational Health & Safety
18CV654	Sustainability Concepts in Civil Engineering
18CV655	**Intelligent Transportation Systems**
18CV656	**Conservation of Natural Resources**

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2018 – 19

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(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18CV71	Quality Surveying and Contract Management	Civil Engg.	3	--	--	03	40	60	100	3
2	PCC	18CV72	Design of RCC and Steel Structures	Civil Engg.	3	--	--	03	40	60	100	3
3	PEC	18CV73X	Professional Elective - 2	Civil Engg.	3	--	--	03	40	60	100	3
4	PEC	18CV74X	Professional Elective - 3	Civil Engg.	3	--	--	03	40	60	100	3
5	OEC	18CV75X	Open Elective -B	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CVL76	Computer Aided Detailing of Structures	Civil Engg.	--	2	2	03	40	60	100	2
7	PCC	18CVL77	Geotechnical Engineering Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
8	Project	18CVP78	Project Work Phase - 1		--	--	2	--	100	--	100	1
9	Internship	--	Internship	(If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters)								
				TOTAL	15	04	06	21	380	420	00	20

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective - 2

Course code under 18CV73X	Course Title
18CV731	Theory of Elasticity
18CV732	Air Pollution and Control
18CV733	Pavement Materials & Construction
18CV734	Ground Water Hydraulics
18CV735	Masonry Structures

Professional Electives - 3

Course code under 18CV74X	Course Title
18CV741	Earthquake Engineering
18CV742	Design Concepts of Building Services
18CV743	Reinforced Earth Structures

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18CV744	Design of Hydraulic Structures
18CV745	Urban Transport Planning
	Open Elective -B
Course code under 18CV75X	**Course Title**
18CV751	Finite Element Method
18CV752	Numerical Methods and Applications
18CV753	Environmental Protection and Management

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Project work:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the Project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P					
1	PCC	18CV81	Design of Pre-stressed Concrete	Civil Engg.	3	--	--	03	40	60	100	3
2	PEC	18CV82X	Professional Elective - 4	Civil Engg.	3	--	--	03	40	60	100	3
3	Project	18CVP83	Project Work Phase - 2	Civil Engg.	--	--	16	03	40	60	100	8
4	Seminar	18CVS84	Technical Seminar	Civil Engg.	--	--	2	03	100	--	100	1
5	Internship	18CVI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
				TOTAL	**06**	--	**18**	**15**	**260**	**240**	**500**	**18**

Note: PCC: Professional Core, PEC: Professional Elective.

Professional Electives - 4

Course code under 18CV82X	Course Title
18CV821	Bridge Engineering
18CV822	Prefabricated Structures
18CV823	Advanced Foundation Engineering
18CV824	Rehabilitation & Retrofitting
18CV825	Pavement Design

Project Work

CIE procedure for Project Work Phase - 2:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE for Project Work Phase - 2:

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(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department. **(ii) Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to. **Internship:** Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.
AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

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B.E.(Common to all Programmes)

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

(Common to all Programmes)

Course Code	**18MAT31**	CIE Marks	40
Teaching Hours/Week (L: T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transform: Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.

Inverse Laplace Transform: Definition and problem s, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.

Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform and applications to solve difference equations.

Module-4

Numerical Solutions of Ordinary Differential Equations(ODE's):

Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge - Kutta method of fourth order, Milne's and Adam-Bash forth predictor and corrector method (No derivations of formulae)-Problems.

Module-5

Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).

Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Course outcomes: At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5:Determine the externals of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6th Edition, 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11th Edition,2010
4	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	6th Edition, 2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

STRENGTH OF MATERIALS

Course Code	**18CV32**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To determine slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

Module-1

Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

Module-2

Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses. Theory of failures: Max. Shear stress theory and Max. principal stress theory.

Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

Module-3

Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.

Module-4

Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre (only concept).

Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft.

Module-5

Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.

Columns and Struts: Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.

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Course outcomes: After studying this course, students will be able:

1. To evaluate the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To evaluate the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse different internal forces and stresses induced due to representative loads on structural elements.
4. To evaluate slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. B.S. Basavarajaiah, P. Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition,2010
2. Ferdinand P. Beer, E. Russell Johnston and Jr. John T. De Wolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

Reference Books:

1. D.H. Young, S.P. Timoshenko "Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint2014).
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010.
3. S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint2013).
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

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B. E. CIVIL ENGINEERING

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - III

FLUIDS MECHANICS

Course Code	**18CV33**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to solve practical problem.
3. Principles of Kinematics and Hydrodynamics for practical applications.
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements.

Module-1

Fluids & Their Properties: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Newton's law of viscosity (theory & problems), Cohesion, Adhesion, Surface tension, Pressure inside a water droplet, soap bubble and liquid jet. Numerical problems,& Capillarity. Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, Fluid as a continuum,

Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.

Module-2

Hydrostatic forces on Surfaces: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

Fundamentals of fluid flow (Kinematics): Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three- dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irrational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.

Module-3

Fluid Dynamics: Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses).

Momentum equation problems on pipe bends.

Applications: Introduction. Venturi meter, Orifice meter, Pitot tube. Numerical Problems.

Module-4

Orifice and Mouth piece: Introduction, classification, flow through orifice, hydraulic coefficients and Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).

Notches and Weirs: Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.

Module-5

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Flow through Pipes: Introduction. Major and minor losses in pipe flow. Darcy- Weis bach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Numerical problems. Pipe Networks, Hardy Cross method (No problems on pipe networks).

Surge Analysis in Pipes: Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems.

Course outcomes: After successful completion of the course, the student will be able to:

1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum
2. Compute and solve problems on hydrostatics, including practical applications
3. Apply principles of mathematics to represent kinematic concepts related to fluid flow
4. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
5. Compute the discharge through pipes and over notches and weirs

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi

Reference Books:

1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed).
2. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
3. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.
4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition.
5. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III
BUILDING MATERIALS AND CONSTRUCTION

Course Code	18CV34	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will develop a student;

1. To recognize good construction materials based on properties.
2. To investigate soil properties and design suitable foundation.
3. To understand the types and properties of masonry materials and supervise masonry construction.
4. To gain knowledge of structural components like lintels, arches, staircase and roofs.
5. To understand the finishes in construction like flooring, plastering, paining.

Module-1

Building Materials: Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.
Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks.
Timber as construction material.
Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.
Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

Module-2

Foundation: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation
Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls.

Module-3

Lintels and Arches: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.
Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles.
Roof: Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

Module-4

Doors, Windows and Ventilators: Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Paneled and glazed Window, Bay Window, French window. Steel windows, Ventilators. Sizes as per IS recommendations.
Stairs: Definitions, technical terms and types of stairs: Wood, RCC, Metal. Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.
Formwork: Introduction to form work, scaffolding, shoring, under pinning.

Module-5

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Plastering and Pointing: Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, defects in plastering . Water proofing with various thicknesses.

Damp proofing- causes, effects and methods.

Paints- Purpose, types, technical terms, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

Course outcomes: After a successful completion of the course, the student will be able to:

1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Decide suitable type of foundation based on soil parameters
3. Supervise the construction of different building elements based on suitability
4. Exhibit the knowledge of building finishes and form work requirements

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

Textbooks:

1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015,StandardPublishers
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.

Reference Books:

1. S. K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. P C Vergese, "Building Materials", PHI Learning Pvt.Ltd
3. Building Materials and Components, CBRI, 1990,India
4. Jagadish. K.S, "Alternative Building Materials Technology", New Age International,2007.
5. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – III

BASIC SURVEYING

Course Code	**18CV35**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Module-1

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.

Measurement of Horizontal Distances: Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems.

Module-2

Measurement of Directions and Angles: Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems.

Module-3

Leveling: Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling.

Module-4

Plane Table Surveying: Plane table and accessories, Advantages and limitations of plane table survey, Orientation and methods of orientation, Methods of plotting – Radiation, Intersection, Traversing, Resection method, Two point and three point problems, Solution to two point problem by graphical method, Solution to three point problem Bessel's graphical method, Errors in plane table survey.

Module-5

Areas and Volumes: Measurement of area by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- trapezoidal and prismoidal formula.

Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.

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Course outcomes: After a successful completion of the course, the student will be able to:

1. Posses a sound knowledge of fundamental principles Geodetics
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
3. Capture geodetic data to process and perform analysis for survey problems]
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi –2009.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune VidyarthiGrihaPrakashan,1988

Reference Books:

1. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi.2009.
2. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. –2010
3. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, NewDelhi
4. A. Bannister, S. Raymond , R. Baker, "Surveying", Pearson, 7th ed., NewDelhi

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ENGINEERING GEOLOGY			
Course Code	**18CV36**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students;

1. To inculcate the importance of earth's interior and application of Geology in civil engineering. Attempts are made to highlight the industrial applications of minerals.
2. To create awareness among Civil engineers regarding the use of rocks as building materials.
3. To provide knowledge on dynamic Geology and its importance in modifying the physical character of rocks which cause rocks suitable or unsuitable in different civil engineering projects such as Dams, bridges, tunnels and highways.
4. To educate the ground water management regarding diversified geological formations, climatologically dissimilarity which are prevailed in the country. To highlight the concept of rain water harvesting.
5. To understand the application of Remote Sensing and GIS, Natural disaster and management and environmental awareness.

Module-1

Introduction: Application of Geology in Civil Engineering Practices, Understanding the earth, internal structure and composition.

Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chro mite (Alloy); Bauxite (aluminum); Chalcopyrite (copper).

Module-2

Petrology & Geomorphology: Formation, Classification and Engineering Properties of: **Igneous rocks**-Types of Granite, Dolerite, Basalt, Pumice, Granite Porphyry. **Sedimentary Rocks**- Sandstone, Limestone, Shale, Late rite, Conglomerate. **Metamorphic Rocks**- Gneiss, Slate, Muscovite & Biotite schist, Marble, Quartzite. Rock weathering: types and their effects on Civil Engineering Projects. Landforms, Drainage pattern and types. Soil formation and soil profile. The apprehension of Index properties of rocks: Porosity, Density, Permeability, and Durability. Selection of rocks as materials for construction, as a foundation, Decorative, Flooring, and Roofing, Concrete Aggregate, Road Metal, Railway Ballast with examples.

Module-3

Structural Geology & Rock Mechanics: Structural aspects of rocks like Outcrop, Dip and strike, Folds, Faults, Joints, Unconformities and their influence on Engineering Projects/structures like dam, tunnels, slope treatment; ground improvement, recognition of the structures in field and their types/classification. Rock Quality Determination (RQD) & Rock Structure Rating (RSR). Geological site characterization: Dam foundations and rock Foundation treatment for dams and Reservoirs heavy structures by grouting and rock reinforcement. Tunnels: Basic terminology and application, site investigations, Coastlines and their engineering considerations.

Module-4

Hydrogeology: Hydrological cycle, Vertical distribution of groundwater, artesian groundwater in soil and rock. Water Bearing Formations, Aquifer and its types – Aquitard, Aquifuge, and Aquiclude. Porosity, Specific yield and retention, Permeability, Transmissibility and Storage Coefficient. Determination of Quality - SAR, RSC and TH of Groundwater. Groundwater Exploration- Electrical Resistivity and Seismic methods, Artificial Recharge of Groundwater, Rain water harvesting and methods, Seawater intrusion in coastal areas and remedies. Groundwater Pollution. Floods and its control, Cyclone and its effects.

Module-5

Seismology and Geodesy: Earthquake - Causes and Effects, Seismic waves, engineering problems related to Earthquakes, Earthquake intensity, Richter scale, Seismograph, Seismic zones- World and India. Tsunami causes and effects, Volcanic Eruptions. Landslides (Mass movements) causes, types and remedial measures –stability assessment for soil and rock slopes. Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) –

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Concept and their use resource mapping. Aerial Photography, LANDSAT Imagery – Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply geological knowledge in different civil engineering practice.
2. Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials.
3. Civil Engineers are competent enough for the safety, stability, economy and life of the structures that they construct.
4. Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems.
5. Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering construction.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P.K. Mukerjee, "A Text Book of Geology", World Press Pvt., Ltd.Kolkatta.
2. Parbin Singh, "Text Book of Engineering and General Geology", Published by S.K.Kataria and Sons, New Dehli.

Reference Books:

1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur. Dimitri P Krynine and William R Judd, "Principles of Engineering Geology and Geotechnics", CBS Publishers and Distributors, New Delhi.
2. K V G K Gokhale, "Principles of Engineering Geology", B S Publications, Hyderabad.
3. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.
5. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.
6. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills
7. K. Todd, "Groundwater Hydrology", Tata Mac Grow Hill, NewDelhi.
8. D. Venkata Reddy, "Engineering Geology", New Age International Publications, NewDelhi.
9. S.K Duggal, H.K Pandey and N Rawal, "Engineering Geology", McGrawHill Education (India) Pvt, Ltd. Ne Delhi.
10. M.P Billings, "Structural Geology", CBS Publishers and Distributors, New Delhi.
11. K. S. Valdiya, "Environmental Geology",, Tata Mc Grew Hills.
12. M. B. Ramachandra Rao, "Outlines of Geophysical Prospecting- A Manual for Geologists", Prasaranga, University of Mysore, Mysore

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

COMPUTER AIDED BUILDING PLANNING AND DRAWING			
Course Code	**18CVL37**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Total Number of Lecture/Practice Hours	02	Exam Hours	03

Course Learning Objectives: Provide students with a basic understanding

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

Module:1

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

Simple engineering drawings with CAD drawing tools : Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.

Module:2

Drawings Related to Different Building Elements:

Following drawings are to be prepared for the data given using CAD Software

a) Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
b) Different types of bonds in brick masonry.
c) Different types of staircases – Dog legged, Open well.
d) Lintel and chajja.
e) RCC slabs and beams.
f) Cross section of a pavement.
g) Septic Tank and sedimentation Tank.
h) Layout plan of Rainwater recharging and harvesting system.
i) Cross sectional details of a road for a Residential area with provision for all services.,
j) Steel truss (connections Bolted).

Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing.

Module -3:

Building Drawings: Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for:

1. Single and double story residential building.
2. Hostel building.
3. Hospital building.
4. School building.

Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:

- Students should sketch to dimension the above in a sketch book before doing the computer drawing
- One compulsory field visit/exercise to be carried out.
- Single line diagrams to be given in the examination.

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Course Outcomes: After studying this course, students will be able to

1. Prepare, read and interpret the drawings in a professional set up.
2. KnowtheproceduresofsubmissionofdrawingsandDevelopworkingandsubmissiondrawingsforbuilding.
3. Plananddesignaresidentialorpublicbuildingasperthegivenrequirements.

Question paper pattern:

- There will be four full questions with sub divisions if necessary from Module2 with each full question carrying twenty five marks. Students have to answer any two questions.
- There will be two full questions from Module 3 with each full question carrying fifty marks. Students have to answer any one question. The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. Question papers should be given in batches.

Textbook:

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing" , Tata McGraw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvt Ltd.

Reference Books:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.
2. IS: 962-1989 (Code of practice for architectural and building drawing).
3. National Building Code, BIS, New Delhi.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

BUILDING MATERIALS TESTING LABORATORY

Course Code	**18CVL38**	**CIE Marks**	**40**
Teaching Hours/Week(L:T:P)	**(0:2:2)**	**SEE Marks**	**60**
Credits	**02**	**Exam Hours**	**03**

Course Learning Objectives: The objectives of this course is to make students to learn:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Experiments:

1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections.
4. Bending Test on Wood Under two point loading.
5. Shear Test on Mild steel- single and double shear.
6. Impact test on Mild Steel (Charpy & Izod).
7. Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's.
8. Tests on Bricks, Tiles and Concrete Blocks.
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking.
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis.
11. Demonstration of Strain gauges and Strain indicators.

NOTE: All tests to be carried out as per relevant latest BIS Codes

Course Outcomes: After successful completion of the course, the students will be able to:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

Question paper pattern:

- Group experiments - Tension test, compression test, torsion test and bending test.
- Individual Experiments – Remaining tests.
- Two questions are to be set - One from group experiments and the other as individual experiment.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

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1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education (India)Pvt. Ltd.,2014.
3. Fenner, "Mechanical Testing of Materials", George Newnes Ltd. London.
4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.
5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd. New Delhi.
6. Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors1996.
7. Relevant **latest IS Codes.**

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B. E. (Common to all Programmes)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER –II / III / IV

Aadalitha Kannada

Course Code	**18KAK28/39/49**	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)		
Credits	01		

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ. ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಪರಿವಿಡಿ (ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)

ಅಧ್ಯಾಯ – 1 ಕನ್ನಡಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ.

ಅಧ್ಯಾಯ – 2 ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ.

ಅಧ್ಯಾಯ – 3 ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.

ಅಧ್ಯಾಯ – 4 ಪತ್ರ ವ್ಯವಹಾರ.

ಅಧ್ಯಾಯ – 5 ಆಡಳಿತ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 6 ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 7 ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧ ರಚನೆ (ಪ್ರಿಸೈಸ್ ರೈಟಿಂಗ್), ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ.

ಅಧ್ಯಾಯ – 8 ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ.

ಅಧ್ಯಾಯ – 9 ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ.

ಅಧ್ಯಾಯ – 10 ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಫಲಿತಾಂಶಗಳು:

- ಆಡಳಿತ ಭಾಷೆ ಕನ್ನಡದ ಪರಿಚಯವಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳು ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – ಅಐಇ (ಅಟಿಣಟಿಣಿಚಿ ಟಿಣಿಚಿಚಿಟಿಚಿಟಿ ಇಚಿಟಿಣಿಚಿಣ):
ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ
ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

ಪಠ್ಯಪುಸ್ತಕ : ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಏಟಿಟಿಟಿಚಿಟಿ ಜಿಡಿ ಂಚಿಟ್ಯೂಡಿಚಿಣ)

ಸಂಪಾದಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

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B. E. (Common to all Programmes) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER –II & III/IV			
Vyavaharika Kannada			
Course Code	18KVK28/39/49	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)		
Credits	01		

Course Learning Objectives:

The course will enable the students to understand Kannada and communicate in Kannada language.

Table of Contents:

Chapter - 1: Vyavaharika kannada – Parichaya (Introduction to Vyavaharika Kannada).

Chapter - 2: Kannada Aksharamale haagu uchcharane (Kannada Alpabets and Pronunciation).

Chapter - 3: Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication).

Chapter - 4: Kannada Grammar in Conversations (Sambhashaneyalli Kannada Vyakarana).

Chapter - 5: Activities in Kannada.

Course Outcomes:

At the end of the course, the student will be able to understand Kannada and communicate in Kannada language.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – [illegible] ([illegible]):
ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

[illegible] (ಪಠ್ಯಪುಸ್ತಕ): ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ ([illegible])

ಸಂಪಾದಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

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B. E. AUTOMOBILE ENGINEERING Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER - III			
CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)			
Course Code	18CPC39/49	CIE Marks	40
Teaching Hours/Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Course Learning Objectives: To

- know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
- Know about the cybercrimes and cyber laws for cyber safety measures.

Module-1

Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

Module-2

Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States.

Module-3

Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.

Constitutional special provisions: Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

Module-4

Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering

Module-5

Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

Course Outcomes: On completion of this course, students will be able to,

- CO1: Have constitutional knowledge and legal literacy.
- CO2: Understand Engineering and Professional ethics and responsibilities of Engineers.
- CO3: Understand the the cybercrimes and cyber laws for cyber safety measures.

Question paper pattern for SEE and CIE:

- The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ).
- For the award of 40 CIE marks, refer the University regulations 2018.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year

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Textbooks				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, and et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
Reference Books				
3	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall,	2008.
4	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall,	2004

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B. E. Common to all Programmes
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ADDITIONAL MATHEMATICS – I
(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech programmes)

Course Code	**18MATDIP31**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	0	Exam Hours	03

Course objectives:
- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.
- To provide an insight into vector differentiation and first order ODE's.

Module-1
Complex Trigonometry: Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
Vector Algebra: Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

Module-2
Differential Calculus: Review of successive differentiation-illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.

Module-3
Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.

Module-4
Integral Calculus: Review of elementary integral calculus. Reduction formulae for $\sin^n x$, $\cos^n x$ (with proof) and $\sin^m x \cos^n x$ (without proof) and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.

Module-5
Ordinary differential equations (ODE's. Introduction-solutions of first order and first degree differential equations: exact, linear differential equations. Equations reducible to exact and Bernoulli's equation.

Course outcomes: At the end of the course the student will be able to:
- CO1: Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
- CO2: Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
- CO3: Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
- CO4: Learn techniques of integration including the evaluation of double and triple integrals.

CO5: Identify and solve first order ordinary differential equations.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43rd Edition,

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				2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10^{th} Edition, 2015
2	Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2007
3	Engineering Mathematics Vol.I	Rohit Khurana	Cengage Learning	1^{st} Edition, 2015

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B.E.(Common to all Programmes)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - IV

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

(Common to all Programmes)
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18MAT41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	3	Exam Hours	03

Course Learning Objectives:

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions: Milne-Thomson method-Problems.

Module-2

Conformal transformations: Introduction. Discussion of transformations: $w=z^2$, $w=e^z$, $w=z+\frac{1}{z},(z\neq 0)$

. Bilinear transformations- Problems.
Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Module-4

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-
$y=ax+b, y=ax^b$ & $y=ax^2+bx+c$.
Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems.

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.
Sampling Theory: Introduction to sampling distributions, standard error,Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

Course outcomes: At the end of the course the student will be able to:

- CO1: Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- CO2: Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- CO3: Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- CO4: Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- CO5: Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10^{th} Edition,2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44^{th} Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3^{rd} Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill	6^{th} Edition 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4^{th} Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11^{th} Edition,2010
4	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	6^{th} Edition, 2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

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B. E. CIVIL ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV
ANALYSIS OF DETERMINATE STRUCTURES

Course Code	**18CV42**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. To understand different forms of structural systems.
2. To understand concept of ILD and moving loads.
3. To determine slopes and deflections of beams and trusses.
4. To analyse arches and cables.

Module-1

Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems.

Influence Lines: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses and numerical problems.

Module-2

Moving Loads: Reactions, BM and SF in determinate beams, axial forces in determinate trusses for rolling loads using ILD (Max. values and absolute max. values for beams subjected to multiple loads).

Module-3

Deflection of Beams: Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections

Module-4

Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castig liano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit load method.

Module-5

Arches and Cable Structures: Three hinged parabolic and circular arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.

Course Outcomes: After studying this course, students will be able to:
1. Identify different forms of structural systems.
2. Construct ILD and analyse the beams and trusses subjected to moving loads
3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and beams.
4. Determine the stress resultants in arches and cables.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module.

Textbooks:
1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., NewDelhi,2015.
3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi,2002.

Reference Books:
1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition,2014.

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2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi,2008.
3. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd,2007.

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CIVIL ENGINEERING

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - IV

APPLIED HYDRAULICS

Course Code	**18CV43**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Module-1

Dimensional analysis: Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ծ theorem, dimensional analysis, choice of variables, examples on various applications. **Model analysis:** Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynolds's, and Froude's Model

Buoyancy and Flotation: Buoyancy, Force and Centre of Buoyancy, Meta centre and Meta centric height, Stability of submerged and floating bodies, Determination of Meta centric height, Experimental and theoretical method, Numerical problems.

Module-2

Open Channel Flow Hydraulics: Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Numerical Problems

Module-3

Non-Uniform Flow: Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems on identifying the flow profiles

Module-4

Impact of jet on Curved vanes: Introduction, Impulse-Momentum equation. Direct impact of a jet on stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems.

Turbines – Impulse Turbines: Introduction to turbines, General lay out of a hydro- electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel- components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems.

Module-5

Reaction Turbines and Pumps: Radial flow reaction turbines: (i) Francis turbine- Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

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Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections. Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, NewDelhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi.

Reference Books:

1. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co.Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford UniversityPress.
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Publication –2010.
4. J.B. Evett, and C. Liu, "Fluid Mechanics and Hydraulics", McGraw-Hill Book Company.-2009.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

CONCRETE TECHNOLOGY

Course Code	**18CV44**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to:
1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Module-1

Concrete Ingredients Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice huskash.

Module-2

Fresh Concrete Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

Module-3

Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

Module-4

Concrete Mix Proportioning
Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.

Module-5

Special Concretes
RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High Performance Concrete.

Course outcomes: After studying this course, students will be able to:
1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behavior based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
4. Adopt suitable concreting methods to place the concrete based on requirement.
5. Select a suitable type of concrete based on specific application.

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Neville A.M. "Properties of Concrete"-4th Ed., Longman.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
4. A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (NewEdition).

Reference Books:

1. M L Gambir, "Concrete Technology", McGraw Hill Education,2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning,2015.
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

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B. E. CIVIL ENGINEERING

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - IV

ADVANCED SURVEYING

Course Code	**18CV45**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Objectives: This course will enable students to

1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

Module-1

Theodolite Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite.

Trigonometric Levelling: Trigonometric leveling (heights and distances-single plane and double plane methods).

Module-2

Tacheometry: Basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems.

Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations.

Module-3

Curve Surveying:

Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (Numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two Parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics, numerical problems on Length of Transition curve, Vertical curves & Types – (theory).

Module-4

Aerial Photogrammetry

Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problen Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of ae survey, overlaps and mosaics, Stereoscopes, Derivation Parallax.

Module-5

Modern Surveying Instruments

Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey.

Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system

Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).

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Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply the knowledge of geometric principles to arrive at surveying problems
2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;
4. Design and implement the different types of curves for deviating type of alignments.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd., New Delhi.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part 2, Pune Vidyarthi Griha Prakashan,
3. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi.
4. SateeshGopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi.

Reference Books:

1. S.K. Duggal, "Surveying Vol. I & II", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBSpublishers
4. B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
5. T.M Lillesand, R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and SonsIndia
6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw HillPublication.
7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill HigherEducation.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

WATER SUPPLY AND TREATMENT ENGINEERING

Course Code	**18CV46**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

Module -1

Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor.
Design period and factors governing design period. Methods of population forecasting and numerical problems

Module -2

Water Treatment: Objectives, Unit flow diagrams – significance of each unit: Sources and Characteristics of surface and subsurface sources and Suitability. Sampling : Objectives, methods and preservation techniques. Drinking water quality standards as per BIS. Effect of water quality parameters.
Intake structures – types. Factors to be considered in selection of site for intake structures. Aeration process, limitations, types and two film theory.

Module -3

Sedimentation -theory, settling tanks, types and design. Coagulation and flocculation, Clarriflocculators (circular and rectangular). theory, types of coagulants, coagulant feeding devices. Jar test apparatus and estimation of coagulants.
Filtration: mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system

Module -4

Disinfection: Theory of disinfection. Methods of disinfection with merits and demerits. Chlorination: Break point chlorination and determination of chlorine demand. Estimation of quantity bleaching powder.
Miscellaneous treatment Process: Softening: Lime soda and Zeolite process. Estimation of Hardness. Fluoridation and De-fluoridation, Nalagonda Technique. RO and Nano filtration process with merits and demerits.

Module -5

Collection and Conveyance of water: Types of pumps with working principles and numerical Problems. Design of the economical diameter for the rising main.
Pipe appurtenances, Valves, Fire hydrants and different Pipe materials with their advantages and disadvantages. Factors affecting selection of pipe material.
Distribution system: Methods: Gravity, Pumping and Combined gravity and pumping system. Types of Distribution system. Service reservoirs and their capacity determination plant units and distribution system with population forecasting for the given city.

Course Outcomes: After studying this course, students will be able to:
1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York,2000
2. S. K. Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010
3. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.

Reference Books:

1. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.
2. Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York,2008.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

ENGINEERING GEOLOGY LABORATORY

Course Code	**18CVL47**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students

1. To expose the students to identify the minerals and rocks based on their inherent properties and uses in civil engineering,
2. To educate the students in the interpretation of the geological maps related to civil engineering projects.
3. Students will learn the dip and strike, thickness of strata, Bore hole problems related to geological formation related to foundation, tunnels, reservoirs and mining.
4. Students will understand the Field knowledge by visiting the site like problems Faults, Folds, Joints, Unconformity etc.

Experiments

1. Physical properties of minerals: Identification of
   i. Rock Forming minerals - Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Asbestos, Calcite, Gypsum, etc
   ii. Ore forming minerals- Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc

2. Engineering Properties of Rocks: Identification of
   i. Igneous rocks- Types of Granites, Dolerite, Granite Porphyry, Basalt, Pumice etc
   ii. Sedimentary rocks- Sandstone, Lime stone, Shale, Laterite, Breccia etc
   iii. Metamorphic rocks- Gneiss, Slate, Schist, Marble, Quartzite etc

3. Borehole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining. Triangular and Square methods. (2 methods)

4. Dip and Strike problems. Determine Apparent dip and True dip. (2 methods)

5. Calculation of Vertical, True thickness and width of the outcrops. (3 methods)

6. Study of Toposheets and Interpretation, Extraction of Drainage Basin and its Morphometric Analysis. (3Toposheets)

7. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc. (10 Maps)

8. Interpretation of Satellite Images. (2 Satellite images)

9. Field work– To identify Minerals, Rocks, Geomorphology and Structural features with related to the Civil Engineering projects.

Course outcomes: During this course, students will develop expertise in;

1. The students able to identify the minerals, rocks and utilize them effectively in civil engineering practices.
2. The students will interpret and understand the geological conditions of the area for implementation of civil engineering projects.
3. The students will interpret subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
4. The students will learn the techniques in the interpretation of LANDSAT Imageries to find out the lineaments and other structural features for the given area.
5. The students will be able to identify the different structures in the field.

Reference Books:

1. MP Billings, Structural Geology, CBS Publishers and Distributors, New Delhi.
2. B.S. Satyanarayana Swamy, Engineering Geology Laboratory Manual, Dhanpat Rai Sons, New Delhi.
3. LRA Narayan, remote sensing and its applications, UniversityPress.
4. P.K.MUKERJEE, Textbook of Geology, WorldPress Pvt. Ltd., Kolkatta
5. Johnl Plattand John Challinor, Simple Geological Structures,ThomasMurthy&Co, London.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

Course Code	18CVL48	CIE Marks	40
Teaching ours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

Experiments:

1. Verification of Bernoulli's equation.
2. Determination of Cd for Venturimeter and Orifice meter.
3. Determination of hydraulic coefficients of small vertical orifice.
4. Determination of C_d for Rectangular and Triangular notch
5. Determination of C_d for Ogee and Broad crested weir
6. Determination of C_d for Venturiflume
7. Determination of force exerted by a jet on flat and curved vanes.
8. Determination of efficiency of Pelton wheel turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major Loss in Pipes
13. Determination of Minor losses in pipe due to sudden enlargement, sudden contraction and bend.

Course outcomes: During the course of study students will develop understanding of:

1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him.
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script.

Reference Books:

1. Sarbjit Singh , Experiments in Fluid Mechanics - PHI Pvt. Ltd.- New Delhi
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi& D r S.M. Seth, Standard Book House- New Delhi. 2009Edition

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - IV

ADDITIONAL MATHEMATICS – II

(Mandatory Learning Course: Common to All Branches)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech programmes)

Course Code	**18MATDIP41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	60
Credits	00	Exam Hours	03

Course Learning Objectives:

- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

Module-1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.

Module-2

Numerical Methods: Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's one

Module-3

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular Integral restricted to $R(x) = e^{ax}, \frac{sinax}{cosax}, x^n \; for \; f(D)y = R(x)$.

Module-4

Partial Differential Equations (PDE's): Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Module-5

Probability: Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes's theorem, problems.

Course Outcomes: At the end of the course the student will be able to:

- Solve systems of linear equations using matrix algebra.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Classify partial differential equations and solve them by exact methods.
- Apply elementary probability theory and solve related problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43rd Edition, 2015
Reference Books				

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1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2015
2	Engineering Mathematics Vol. I	Rohit Khurana	Cengage Learning	2015.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP

Course Code	**18CV51**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties.

Module -1

Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans.
Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles.
Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, PERT method, concept of activity on arrow and activity on node.

Module -2

Resource Management: Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.
Construction Equipments: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance
Materials: material management functions, inventory management.

Module -3

Construction Quality , safety and Human Values:
Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management
HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.
Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

Module -4

Introduction to engineering economy: Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.
Interest and time value of money: concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.
Comparison of alternatives: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.

Module -5

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Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC.

Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.

Course Outcomes: After studying this course, students will be able to:

1. Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.
2. Understand labour output, equipment efficiency to allocate resources required for an activity / project to achieve desired quality and safety.
3. Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.
4. Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education
2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of PearsonEducation
4. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:

Reference Books:

1. Robert L Peurifoy, Clifford J. Schexnayder, AviadShapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-HillEducation
2. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, NewDelhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw-HillEducation
5. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall,Pitsburgh
6. James L.Riggs, David D. Bedworth , Sabah U. Randhawa " Engineerng Economics" 4

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

ANALYSIS OF INDETERMINATE STRUCTURES

Course Code	**18CV52**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. communicate effectively in design of structural elements

Module-1

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3.

Module-2

Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3.

Module-3

Kani's Method: Introduction, Concept, Relationships between bending momentand deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway.

Module-4

Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3.

Module-5

Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3.

Course Outcomes: After studying this course, students will be able to:

1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams and frames using flexibility method
5. Analyze the beams and indeterminate frames by system stiffness method.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Hibbeler R C, "**Structural Analysis**", Pearson Publication
2. L S Negi and R S Jangid, **"Structural Analysis"**, Tata *McGraw-Hill* Publishing Company Ltd.
3. D S PrakashRao, **"Structural Analysis: A Unified Approach"** , Universities Press
4. K.U. Muthu, H. Narendraetal, **"Indeterminate Structural Analysis"**, IK International Publishing Pvt. Ltd.

Reference Books:

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1. Reddy C S, **"Basic Structural Analysis"**,Tata McGraw-Hill Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, **"Theory of Structures"**, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M MRatwani, **"Analysis Of Structures "**, Vol. 2, Khanna Publishers
4. Wang C K, **"Intermediate Structural Analysis"**, McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, **"Computational Structural Mechanics"**, PHI Learning Pvt. Ltd.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

DESIGN OF RC STRUCTURAL ELEMENTS

Course Code	**18CV53**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. Provide knowledge in analysis and design of RC elements.

Module-1

Introduction to working stress and limit State Design: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method.
Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.
Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

Module-2

Limit State Analysis of Beams:
Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.

Module-3

Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.

Module-4

Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

Module-5

Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.

Course outcomes: After studying this course, students will be able to:
1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
4. Owns professional and ethical responsibility.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.

Textbooks:
1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

Reference Books:

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1. P C Varghese, "Limit State design of reinforced concrete" , PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publishers.
3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications.
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press.
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

BASIC GEOTECHNICAL ENGINEERING

Course Code	**18CV54**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assesstheimprovementinmechanicalbehaviourbydensificationofsoildeposits using compaction.
5. Model and measure strength-deformation characteristics of soils.

Module-1

Introduction: Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.
Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis(sieve and Hydrometer analysis)
Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

Module-2

Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering
Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

Module -3

Flow through Soils: Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.
Seepage Analysis: Laplace equation, assumptions, limitation sand its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section.
Unconfined flow, phreaticline (Casagrande's method–with and without toe filter), flow through dams, design of dam filters.
Effective Stress Analysis:
Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.

Module -4

Shear Strength of Soil: Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.

Module-5

Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidationtheory-assumptionsandlimitations.GoverningdifferentialEquation and solution (No derivation).
Consolidation characteristics of soil (C_C, a_V, m_V and C_V). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils.

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Determination of consolidation characteristics of soils- compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

Course outcomes: On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India.

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, "Geotechnical Engineering", Universities Press.,
5. Malcolm D Bolton, "A Guide to soil mechanics", Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)and Outcome Based Education (OBE)
SEMESTER - V

MUNICIPAL WASTEWATER ENGINEERING

Course Code	**18CV55**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;
1. Understand the various water demands and population forecasting methods.
2. Understand and design different unit operations and unit process in involved in wastewater treatment process
3.Understand the concept and design of various physicochemical treatment units
4. Understand the concept and design of various biological treatment units
5. Understand the concept of various advance waste water and low cost treatment processes for rural areas.

Module-1

Introduction: Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm water flow, time of concentration flow, numericals.
Sewer appurtenances: Manholes, catch basins, oil and grease traps. P, Q and S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers basic principles of house drainage.

Module-2

Design of sewers: Hydraulic formula to determine velocity and discharge. Self cleansing and non scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.
Waste water characteristics: sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water
Treatment unit operations and process. Estimation of BOD. Reaction kinetics (zero order, 1st order and 2nd order).

Module-3

Treatment of municipal waste water: Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks.
Disposal of effluents: Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps equation.

Module-4

Biological Treatment Process: Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors. Principle of stabilization ponds, oxidation ditch, Sludge digesters(aerobic and anaerobic), Equalization., thickeners and drying beds.

Module-5

Advanced Wastewater Treatment: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advance oxidation processes (AOPs), Electro coagulation.
Rural sanitation: Low cost treatment process: Working principal and design of septic tanks for small community in rural and urban areas, two-pit latrines, eco-toilet and soak pits.

Course outcomes: After studying this course, the students will be able to:
1. Select the appropriate sewer appurtenances and materials in sewer network.
2. Design the sewers network and understand the self purification process in flowing water.
3.Deisgn the varies physic- chemical treatment units
4. Design the various biological treatment units
5. Design various AOPs and low cost treatment units.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

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1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. B C Punmia, "Environmental Engineering vol-II", Laxmi Publications 2nd, 2016
3. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3rd Edition. 2017
4. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017

Reference Books

1. CPHEEO manual on sewage treatment, Ministry of Urban Development, Government of India, New Delhi,1999
2. Mark.J Hammer, "Water & Waste Water Technology" John Wiley & Sons Inc., New York, 2008
3. Benefield R.D., and Randal C.W, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey 2012
4. Metcalf and Eddy Inc, "Wastewater Engineering - Treatment and Reuse", Publishing Co. Ltd., New Delhi, 4th Edition, 2009.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

HIGHWAY ENGINEERING

Course Code	**18CV56**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

Module -1

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.
Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.
Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.

Module -2

Highway Geometric Design of horizontal alignment elements: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Radius of curve, Transition curve, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.

Module -3

Pavement Materials: Sub grade soil - desirable properties-HRB soil classification-determination of CBR and modulus of sub grade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.

Module -4

Pavement Construction: Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base iii) WMM base,iv) Bituminous Macadam v) Dense Bituminous Macadam vi) Bituminous Concrete,vii) Dry Lean Concrete sub base and PQC viii) concrete roads.

Module -5

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Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

Course Outcomes: After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K. P.Subramanium, "Transportation Engineering", SciTech Publications, Chennai.

Reference Books:

1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoR T&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

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B. E. CIVIL ENGINEERING

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - V

SURVEYING PRACTICE

Course Code	**18CVL57**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Apply the basic principles of engineering surveying and measurements
2. Followeffectivelyfieldproceduresrequiredforaprofessionalsurveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.
   b) Setting out perpendiculars. Use of cross staff, optical square.
2. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
3. Determination of distance between two inaccessible points using compass and
4. Determination of reduced levels of points using dumpy level/auto level (simple
5. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling).
6. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error.
7. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale.
8. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.
9. Determination of horizontal distance and vertical height to a base in accessible object using theodolite by single plane and double plane method.
10. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
11. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule and Bowditch rule.
12. To locate the points using Radiation and Intersection method of Plane table surveying.
13. To solve three point problem in plane table using Bessel's graphical solution.
14. DemonstrationofMinorinstrumentslikeClinometer,CeylonGhattracer,Boxsextant,Hand level, Planimeter, nautical extant and Penta graph.

Course Outcomes: After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying and for linear and angular measurements.
2. Comprehendeffectivelyfieldproceduresrequiredforaprofessionalsurveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Question paper pattern:

- All are individual experiments.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Textbooks:

1. B.C.Punmia,"SurveyingVol.1",LaxmiPublicationspvt.Ltd.,NewDelhi– 2009.
2. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune Vidyarthi Griha Prakashan, 1988.

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Reference Books:

1. S. K. Duggal, "SurveyingVol.1".Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. 2009.
2. K.R.Arora, "SurveyingVol.1" Standard Book House, New Delhi.-2010.

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B. E. CIVIL ENGINEERING

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - V

CONCRETE AND HIGHWAY MATERIALS LABORATORY

Course Code	**18CVL58**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students

1. To learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
2. To learn the procedure of testing bituminous materials as per standard code recommendations.
3. To relate material characteristics to various application of construction.

Modules

Part A: Concrete Lab

1. Tests on Cement:
    a. Normal Consistency
    b. Setting time
    c. Compressive strength
    d. fineness by air permeability test
    e. specific gravity
2. Tests on Concrete:
    a. Design of concrete mix as perIS-10262
    b. Tests on fresh concrete:
        i. slump,
        ii. compaction factor and
        iii. Vee Bee test
    c. Tests on hardened concrete:
        i. compressive strength test,
        ii. split tensile strength test,
        iii. flexural strength test
    d. NDT tests by re bound hammer and pulse velocity test.
3. Tests on Self Compacting Concrete:
    a. Design of self compacting concrete, As per Is 10262:2019
    b. slump flow test,
    c. V-funnel test,
    d. J-Ring test,
    e. U Box test and
    f. L Box test

Part B: Highway materials Lab

1. Tests on Aggregates
    a. Aggregate Crushing value
    b. Los Angeles abrasion test
    c. Aggregate impact test
    d. Aggregate shape tests(combined index and angularity number)
2. Tests on Bituminous Materials
    a. Penetration test
    b. Ductility test
    c. Softening point test
    d. Specific gravity test
    e. Viscosity test by tarviscometer
    f. Bituminous Mix Design by Marshal Method (Demonstration only)
3. Tests on Soil
    a. Wet sieve analysis
    b. CBR test

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Course Outcomes: During this course, students will develop expertise in

1. Able to interpret the experimental results of concrete and highway materials based on laboratory tests.
2. Determine the quality and suitability of cement.
3. Design appropriate concrete mix Using Professional codes.
4. Determine strength and quality of concrete.
5. Evaluate the strength of structural elements using NDT techniques.
6. Test the soil for its suitability as sub grade soil for pavements.

Question paper pattern:

- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. M. L. Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand &Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual", Nem Chand Bros, Roorkee.
7. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.

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B.E IN CIVIL ENGINEERING(CV-2018-19)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

ENVIRONMENTAL STUDIES

Course Code	**18CIV59**	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course outcomes: At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Question paper pattern:

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012

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2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2nd Edition, 2005
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, AnoopSingh& PiyushMalaviya	Acme Learning Pvt. Ltd. New Delhi.	1st Edition

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B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
DESIGN OF STEEL STRUCTURAL ELEMENTS			
Course Code	**18CV61**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Module -1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

Module -2

Bolted Connections: Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)and bracket connections.

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.

Module -3

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

Module -4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Module -5

Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.

Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems].

Course Outcomes: After studying this course, students will be able to:

1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

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- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi.

Reference Books:

1. Dayarathnam P, "Design of Steel Structures", Scientific International Pvt. Ltd.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI
APPLIED GEOTECHNICAL ENGINEERING

Course Code	**18CV62**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geo-technology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

Module-1

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

Module-2

Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart.
Foundation Settlement: Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.
Stability of Slopes :Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts.

Module-4

Bearing Capacity of Shallow Foundation: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.

Module-5

Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).

Course outcomes: On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Question paper pattern:

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, New Delhi.
3. P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.
4. Punmia B C, Soil Mechanics and Foundation Engineering-(2017), 16thEdition, Laxmi Publications co., New Delhi.

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, "Geotechnical Engineering", Universities Press.,
5. Malcolm D Bolton, "A Guide to soil mechanics", Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.
7. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

HYDROLOGY AND IRRIGATION ENGINEERING

Course Code	**18CV63**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

Module -1

Hydrology: Introduction, Importance of hydrology, Global distribution of water and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

Module -2

Losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control.

Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation.

Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

Module -3

Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.

Module -4

Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation.

Water Requirements of Crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

Module -5

Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.

Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

Course outcomes: After studying this course, students will be able to:

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.

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4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
3. Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.

Reference Books:

1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"-. Standard book house, Delhi.
5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

MATRIX METHOD OF STRUCTURAL ANALYSIS

Course Code	**18CV641**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to
1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses.
3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.
4. Gain knowledge of solving problems involving temperature changes and lack of fit.

Module -1

Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements.

Module -2

Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

Module -3

Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

Module -4

Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

Module -5

Direct Stiffness Method: Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses.

Course Outcomes: After studying this course, students will be able to:
1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
4. Evaluate secondary stresses.

Question paper pattern:

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Weaver W and Gere J H, **"Matrix Analysis of Framed Structures"**, CBS publications, New Delhi.
2. Rajasekaran S, **"Computational Structural Mechanics"**, PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, **"Matrix and Finite Element Analysis of Structures"**, Ane Books Pvt. Ltd.

Reference Books:

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1. Godbole P N et.al, "Matrix Method of Structural Analysis", PHI ltd, New Delhi.
2. Pundit and Gupta, "Theory of Structures Vol II", TMH publications, New Delhi
3. A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee.
4. Manikaselvam, "Elements of Matrix Analysis and Stability of Structures", Khanna Publishers, New Delhi.
5. H C Martin, "Introduction to Matrix Methods in Structural Analysis", International textbook company, McGraw Hill.

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B. E. CIVIL ENGINEERING

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - VI

SOLID WASTE MANAGEMENT

Course Code	**18CV642**	CIE Marks	40
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Module -1

Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.

Collection: Collection of solid waste- services and systems, equipments,

Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.

Module -2

Processing techniques: Purpose of processing, Volume reduction by incineration, Process description, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

Module -3

Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermi composting, Numerical Problems.

Sanitary land filling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems.

Module -4

Sources, collection, treatment and disposal:- Biomedical waste,E-waste, construction and demolition waste.

Module -5

Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolsis , Energy recovery technique from solid waste management. Hazardous waste.

Course outcomes: After studying this course, students will be able to:

1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

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1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd..

Reference Books:

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health and Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solid waste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

ALTERNATE BUILDING MATERIALS

Course Code	18CV643	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This Course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

Module -1

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.

Module -2

Elements of Structural Masonry : Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar.

Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

Module -3

Alternate Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.

Module -4

Alternate Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications.

Top down construction, Mivan Construction Technique.

Alternate Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

Module -5

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Equipment for Production of Alternate Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

Course Outcomes: After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers.

Reference Books:

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

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B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
GROUND IMPROVEMENT TECHNIQUES			
Course Code	18CV644	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geo synthetics, vibration, grouting and Injection.

Module -1

Formation and Development of Ground : Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits;
Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.
Compaction: Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.

Module -2

Drainage Methods: Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.
Pre-compression and Vertical Drains: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

Module -3

Chemical Modification-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.
Chemical Modification-Ii: Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

Module -4

Vibration Methods: Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibro flotation, sand compaction piles, stone columns, heavy tamping
Grouting And Injection: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

Module -5

Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,
Miscellaneous Methods (Only Concepts & Uses): Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.

Course Outcomes: After studying this course, students will be able to:

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.

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- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
2. Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", McGraw Hill Pub. Co.

Reference Books:

1. Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London.
2. Nelson J.D. and Miller D.J, "Expansive soils", John Wiley and Sons.
3. Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths
4. Manfred Hausmann , "Engineering principles of ground modification", McGraw Hill Pub. Co.,

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS

Course Code	18CV645	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.
2. Learndifferenttypesofstructuralcomponents,engineeringpropertiesofthematerials,tocalculatethematerial quantities required for construction
3. Understand various aspects of geometrical elements, points and crossings, significance of maintenance of tracks.
4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
5. Apply design features of tunnels, harbors, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

Module-1

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way
– Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings(Explanation & Sketches of Right and Left hand turnouts only).

Module-2

Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

Module-3

Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design
Principles – Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.
Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

Module-4

Airport Planning: Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

Module-5

Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements ofTaxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

Course outcomes: After studying this course, students will be able to:

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

Question paper pattern:

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- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M. M,"Railway Engineering", 2nd Edition, Oxford University Press,New Delhi.
3. Khanna S K, Arora M G and Jain S S,"Airport Planning and Design", Nemch and and Brothers, Roorkee.
4. CVenkatramaiah,"TransportationEngineering",VolumeII:Railways,Airports,DocksandHarbours,Bridgesand Tunnels, Universities Press.
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.

Reference Books:

1. Oza.H.P.andOza.G.H.,"AcourseinDocks&HarbourEngineering".Charotar Publishing Co.,
2. Mundrey J. S. "A course in Railway Track Engineering".Tata Mc Graw Hill.
3. Srinivasan R. Harbour," Dock and TunnelEngineering",26thEdition2013.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

REMOTE SENSING AND GIS

Course Code	**18CV651**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required units.
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic camps for various applications.

Module-1

Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

Module-2

Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

Module-3

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

Module-4

Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, and Data conversion.

Module-5

Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications.

Course outcomes: After studying this course, students will be able to:

1. Collectdataanddelineatevariouselementsfromthesatelliteimageryusingtheirspectralsignature.
2. Analyze different features of ground information to create raster or vector data.
3. Perform digital classificationandcreatedifferentthematicmapsforsolvingspecificproblems
4. Make decision based on the GIS analysis on thematic maps.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

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1. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press2008.
2. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press2011
3. Kang – T surg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited2015.
4. Lilles and, Kiefer, Chipman,"RemoteSensingandImageInterpretation",Wiley2011.

Reference Books:

1. Chor Pang Lo and Albert K.W Yeung, "Concepts &Techniques of GIS", PHI,2006
2. John R. Jensen, "Remote sensing of the environment", an earth resources perspective–2nd edition– by Pearson Education2007.
3. Anji Reddy M., "Remote sensing and Geographical information system", B. S. Publications2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications2004.
5. S Kumar,"Basics of remote sensing & GIS", Laxmi publications 2005.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

TRAFFIC ENGINEERING

Course Code	**18CV652**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analyzing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

Module-1

Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service-Concept, applications and significance.

Module-3

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.

Module-4

Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

Module-5

Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

Course outcomes: After studying this course, students will be able to:

1. Understandthehumanfactorsandvehicularfactorsintrafficengineeringdesign.
2. Conductdifferenttypesoftrafficsurveysandanalysisofcollecteddatausingstatisticalconcepts.
3. Useanappropriatetrafficflowtheoryandtocomprehendthecapacity&signalizedintersectionanalysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

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1. Kadiyali. L.R. "Traffic Engineering and Transport Planning ", Khanna Publishers, Delhi,2013
2. S K Khanna and CEG Justo and AVeeraragavan, "Highway Engineering", Nem Chand and Bros.
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4. Salter. R.I and Hounsell N.B. "Highway Traffic Analysis and design", Macmillan PressLtd.1996

Reference Books:

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi,2011.
2. GarberandHoel,"PrinciplesofTrafficandHighwayEngineering",CENGAGELearning,NewDelhi,2010.
3. SP: 43-1994,IRCSpecification,"Guidelineson Low-cost Traffic Management Techniques" for Urban Areas,1994.
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996.
5. Hobbs.F.D."Traffic Planning and Engineering",University of Brimingham,Peragamon Press Ltd,2005.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

OCCUPATIONAL HEALTH AND SAFETY

Course Code	18CV653	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Gainan historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify work place problems and safe work practice

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation.

Module-2

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.

Module-3

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.
Electrical Safety, Product Safety: Technical Requirements of Product safety.

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability.

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.

Course outcomes: After studying this course, students will be able to:

1. Identifyhazardsintheworkplacethatposeadangerorthreattotheirsafetyorhealth,orthatofothers.
2. Controlunsafeorunhealthyhazardsandproposemethodstoeliminatethehazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Goetsch D. L.,(1999), "Occupational Safety and Health for Technologists, Engineers and Managers",

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Prentice Hall.
2. HeinrichH.W.,(2007),"IndustrialAccidentPrevention-AScientificApproach",McGraw-HillBookCompany National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3. "Industrial Safety and Pollution Control Handbook.

Reference Books:

1. CollingD.A.,(1990),"IndustrialSafetyManagementandTechnology",PrenticeHall,New Delhi.
2. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

SUSTAINABILITY CONCEPTS IN CIVIL ENGINEERING

Course Code	**18CV654**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frame work sand their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

Module-1

Introduction: Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.

Module-2

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking.

Module-3

Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

Module-4

Clean Technology and Energy: Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

Module-5

Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.

Course Outcomes: After studying this course, students will be able to:

1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
4. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

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- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Allen, D.T. and S honnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley, A.S; Adebayo, A. O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

Reference Books:

1. Mackenthun, K. M.,Basic Concepts in Environmental Management, Lewis Publication.
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System.
3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice.
6. Daniel A. Vallero and Chris Brasier, "Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell.
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers.

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INTELLIGENT TRANSPORTATION SYSTEMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	18CV655	CIE Marks	40
Number of Lecture Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning objectives: This course will enable students to

Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control. Learn how Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic, inform travellers and drivers, operate public transport, automating payments, handle emergencies and incidents, operate commercial fleets and freight exchange, and automate driving and safety.

Module -1

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic InformationSystems (GIS), video data collection.

Module -2

Advanced traveller information systems; transportation network operations; commercial vehicle operations and intermodal freight.

Module -3

Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.

Module -4

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS andsustainable mobility.

Module -5

Travel demand management, electronic toll collection, and ITS and road-pricing.Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITSImplementations in developed countries, ITS in developing countries.

Course outcomes:

After studying this course, students would be able to suggest the appropriate system/s in various functional areas of transportation. Would be able to amalgamate the various systems, plan and implement the applications of ITS. Wouldhave learnt the application of information technology and telecommunication to control traffic and alsoprovide advance information to the travellers, automatic handling of emergencies and to improve safety.

Graduate Attributes (as per NBA)

- *Scholarship of Knowledge.*
- *Critical thinking.*
- *Ethical practices and social responsibility*
- *Use of modern tools*

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Question paper pattern:

1. The question paper will have tenquestions.
2. Each full question consists of 20marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under amodule.
5. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House.
2. Pradip Kumar Sarkar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Publishers

Reference Books:

1. Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)" ITS Hand Book 2000.
2. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005.
3. US Department of Transportation, "National ITS Architecture Documentation", 2007 (CDROM).
4. Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems", Prentice Hall

PRINCIPAL
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CONSERVATION OF NATURAL RESOURCES

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER – VI

Subject Code	**18CV656**	CIE Marks	40
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course learning objectives: This course will enable the students to

- Learn types of land forms , soil conservation and sustainable land use planning.
- Apprehend water resources, types, distribution, planning and conservation.
- Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control.
- Apprehend basics of biodiversity and ecosystems.
-

Module -1

Land: Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning.

Module -2

Water: Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water, its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.

Module -3

Air: Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Economic effects of air pollution. Control of air pollution by equipment, smoke and its control. Ozone depletion –impacts, photochemical changes.

Minerals and rocks: Minerals, important rock forming minerals like Quartz, Mica, Feldspar and Amphibole, lithification & metamorphism, weathering: physical, biogeochemical processes, erosion, agents of erosion.

Module -4

Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry. Ecosystem: Definition, Types: forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of eco system.

Module -5

Global warming: concept, indicators, factors and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity.

EIA: Regulations in India, status of EIA in India, list of projects needing environmental clearance under EIA notifications. Case study of hydro power/ thermal power projects.

Updated on 29.03.2021

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Course Outcomes(CO):

At the end of the course, students will be able to

1. Apprehend various components of land as a natural resource and land use planning.
2. Know availability and distribution for water resources as applied to India.
3. Analyse the components ofair as resource and its pollution.
4. Discuss biodiversity & its role in ecosystem functioning.
5. Critically appreciate the environmental concerns of today.

Question paper pattern:

1. The question paper will have ten questions, carrying equal marks.
2. There will be two full questions with a maximum four sub questions from each module. Students shall answer five full questions selecting one full question from each module.

Text Books:

1. Modi, P.N., "Irrigation Water Resources and Water Power Engineering". Standard Book House, New Delhi. 10th Edition, 2019.
2. Raghunath, H.M., "Groundwater",3rd Edition, New Age International Publishers, New Delhi, 2007.
3. Krishnan, M.S., "Geology of India & Burma". CBS publishers, New Delhi, 2017.
4. P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, New Delhi, 2011.
5. M N Rao and H V N Rao, "Air pollution", McGraw Hill Publications, 2017.
6. Krishnamurthy K.V., "An advanced textbook of Biodiversity- Principle &Practices." Oxford and IBH publications, New Delhi. 2004.

Reference Books :

1. Odum, E.P., "Fundamentals of Ecology", W.B sounders, Philadelphia, USA, 1971
2. Singh J.S, Singh S.P & Gupta, S.R.,"Ecology, environment and resource conservation",Anamayapublications, 2006.
3. Edmond A. Mathez & Jason E. Smerdon, "Climate Change: The science of Global warming and our energy feature", Columbia University Press, 2009.
4. National Council of Applied Economic Research, "Economic Impact of Interlinking of Rivers Program", Revised Final Report, April 2008.
5. http://nwda.gov.in/content.
6. Madhav Gadagil, "Biodiversity and India's degraded lands", Indian Academy of Sciences, Volume 22- No 2/3, http://www.jstor.org/pss/4314063

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

SOFTWARE APPLICATION LABORATORY

Course Code	**18CVL66**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Use industry standard software in a professional set up.
2. Understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design.
3. Develop customized automation tools.

Module -1

Use of civil engineering software's:

Use of software's for:

1. Analysis of plane trusses, continuous beams, portal frames.
2. 3D analysis of multistoried frame structures.

Module -2

1. **Project Management- Exercise on Project planning and scheduling of a building project using any project management software:**

a. Understanding basic features of Project management software
b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.
c. Identification of Predecessor and Successor activities with constrain
d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Othernon Critical paths, Project duration, Floats.
e. Study on various View options available
f. Basic understanding about Resource Creation and allocation
g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project

1. **GIS applications using open source software:**

a. To create shape files for point, line and polygon features with a map as reference.
b. To create decision maps for specific purpose.

Module -3

Use of EXCEL spread sheets:

Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation.

Course Outcomes: After studying this course, students will be able to:
use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Question paper pattern:

- The question paper will have 6 questions under 3 modules.
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics under a module.
- Module-1: 40 Marks, Module-2: 30 Marks, Module-3: 30 Marks.
- The students shall answer three full questions, selecting one full question from each module.

Reference Books: Training manuals and User manuals and Relevant course reference books

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

ENVIRONMENTAL ENGINEERING LABORATORY

Course Code	**18CVL67**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students,
1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

1. Preparation chemical solutions required for analysis and sampling methodologies
2. Determination of pH, Conductivity, TDS and Turbidity.
3. Determination of Acidity and Alkalinity
4. Determination of Calcium, Magnesium and Total Hardness.
5. Determination of Dissolved Oxygen
6. Determination of BOD.
7. Determination of Chlorides
8. Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.
9. Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids, iv) Volatile Solids, Fixed Solids v) Settleable Solids.
10. Determination of optimum coagulant dosage using Jar test apparatus.
11. Determination Nitrates and Iron by spectrophotometer
12. Determination of COD(Demonstration)
13. Air Quality Monitoring (Demonstration)
14. Determination of Sound by Sound level meter at different locations (Demonstration)

Course Outcomes: After studying this course, students will be able to:
1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.
3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

Question paper pattern:
- Two experiments shall be asked from the above set of experiments.
- One experiment to be conducted and for the other student should write detailed procedure.

Reference Books:

1. IS codes-3025 series
2. Standard method for examination of water and waste water, APHA, 20th edition
3. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science", McGraw-Hill Series in Civil and Environmental Engineering.

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5. **TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of; a. Reconnaissance survey for selection of site and conceptualization of project. b. Detailed survey required for project execution like contour surveys c. Preparation of layout plans as per regulations e. Centerline marking-transfer of centre lines from plan to ground f. Design of all elements and preparation of drawing with report as per regulations
Course outcomes: After studying this course, students will be able to: 1. Apply Surveying knowledge and tools effectively for the projects 2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies. 3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills. 4. Professional etiquettes at workplace, meeting and general 5. Establishing trust based relationships in teams & organizational environment 6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques
Reference Books:
Training manuals and User manuals Relevant course reference books

B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
EXTENSIVE SURVEY PROJECT			
Course Code	18CVEP68	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Total Number of Practice Hours	02	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

Note:

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

1. **NEW TANK PROJECTS:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design and preparation of drawing with report.
2. **WATER SUPPLY AND SANITARY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparation of village map by using total station.
   d. Survey work required for laying of water supply and UGD
   e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   f. Design of all elements and preparation of drawing with report.
3. **HIGHWAY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
   c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
   d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.
4. **RESTORATION OF AN EXISTING TANK:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design of all elements and preparation of drawing with report.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

QUANTITY SURVEYING AND CONTRACT MANAGEMENT

Course Code	18CV71	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;
1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project
2. Understand and apply the concept of Valuation for Properties
3. Understand, Apply and Create the Tender and Contract document.

Module -1

Quantity Estimation for Building: study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by Short wall and long wall method - centre line method.
Estimate of R.C.C structures including Slab, beam, column, footings.

Module -2

Estimate of Steel truss, manhole and septic tanks and slab culvert.
Quantity Estimation for Roads: Computation of volume of earthwork fully in banking, cutting, partly cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods.

Module -3

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings and roads.
Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost
Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

Module-4

Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).
Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture.
Contract Forms: FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC.

Module -5

Contract Management-Post award : Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, **Disputes & its resolution mechanism,** Contract management and administration.
Valuation: Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.

Course outcomes: After studying this course, students will be able to:
1. Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.
2. Prepare detailed and abstract estimates for various road works, structural works and water supply and sanitary works.
3. Prepare the specifications and analyze the rates for various items of work.
4. Assess contract and tender documents for various construction works.
5. Prepare valuation reports of buildings.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.

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- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi.

Reference Books:

1. Kohli D.D and Kohli R.C, "Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi.
7. David Pratt, "Fundamentals of Construction Estimating" – 3ed, Edition.
8. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms.
9. B.S. Ramaswamy "Contracts and their Management" 3ed, Lexis Nexis(a division of Reed Elsevier India Pvt Ltd).

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

DESIGN OF RCC AND STEEL STRUCTURES

Course Code	**18CV72**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
2. Identify, formulate and solve engineering problems in RC and Steel Structures
3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

Footings: Design of rectangular slab, slab-beam type combined footing.
Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.
Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV).**
Design of portal frames with fixed and hinged based supports.

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.
Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks
Gantry Girder: Design of gantry girder with all necessary checks.

Course Outcomes: After studying this course, students will be able to:

1. Students will acquire the basic knowledge in design of RCC and Steel Structures.
2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Question Paper Pattern:

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 50 marks.
- Code books – IS 456, IS 800, IS 3370 (Part IV), SP-16, SP (6) – Steel Tables, shall be referred for designing. The same will be provided during examination.

Textbooks:

1. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
2. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
3. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:

1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behavior"**, Pearson Publications
2. Nether Cot, et.al, **"Behavior and Design of Steel Structures to EC -III"**, CRC Press
3. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
4. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

THEORY OF ELASTICITY

Course Code	18CV731	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials in to more general, two and three-dimensional problems.
2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
3. Introduction to the stress–strain relationship, basic principles and mathematical expressions involved in continuum mechanics. Also solution of problems in 2-dimensional linear elasticity.

Module-1

Rigid and deformable bodies, body and surface forces, concept of stress, state of stress at a point, Cartesian stress components, Cauchey's stress formula, stress transformation, principal stresses and principal planes, stress invariants, equations of equilibrium in 2D and 3D (Cartesian coordinates).

Module-2

Types of strain, strain displacement relations, state of strain at a point, strain tensor, strain transformation, strain along a linear element, principal strains, strain invariants, octahedral strains, spherical and deviatoric strains.

Module-3

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only). Equations of equilibrium in polar coordinate, compatibility equation, stress function.

Module-4

Axisymmetric stress distribution - Rotating discs, Lame's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

Module-5

Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections.

Course outcomes: After studying this course, students will be able to:

1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum.
2. Ability to formulate boundary value problems; and calculate stresses and strains.
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints.
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 2012.
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford &IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003.

Reference Books:

1. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York,1953.
2. G. W. Housner and T. Vreeland, Jr., "The Analysis o f Stress and Deformation", California Institute of Tech., CA, 2012.[Downloadasperuserpolicyfromhttp://resolver.caltech.edu/CaltechBOOK:1965.001].
3. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", PrenticeHall,2003.
4. Abdel-Rahman Ragab and Salah Eldinin Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press,1998.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII
AIR POLLUTION AND CONTROL

Course Code	18CV732	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

Module-1

Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

Module-2

Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.

Module-3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants ($PM_{2.5}$, PM_{10}, SO_X, NO_X, CO, NH_3). Development of air quality models-Gaussian dispersion model-Including Numerical problems.

Module-4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP - Including Numerical problems. Site selection for industrial plant location.

Module-5

Air pollution due to automobiles, standards and control methods. Noise pollution- causes, effects and control, noise standards. Environmental issues, global episodes. Environmental laws and acts.

Course outcomes: After studying this course, students will be able to:

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication.
2. H. C. Perkins, "Air pollution". Tata McGraw Hill Publication.
3. Mackenzie Davis and David Cornwell, "Introduction t o Environmental Engineering" McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, "Air Pollution Control Engineering", Waveland Pr Inc.
2. Anjaneyulu Y, "Text book of Air Pollution and Control Technologies", Allied Publishers.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

PAVEMENT MATERIALS AND CONSTRUCTION

Course Code	18CV733	CIE Marks	40
Teaching Hours/Week	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

1. Expose students to different materials which are used in pavement construction, impart knowledge about the engineering properties required.
2. To train students to perform various types of bituminous mix designs as per the guidelines (MORTH).
3. Student will get knowledge about different highway construction equipment with their suitability and adaptability in various field scenarios.
4. Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavement as per the required specifications (MORTH).
5. To introduce students to possible improvisation in various layers of pavement to increase the structural strength by the use of non basic materials (DLC, polythene sheets).

Module-1

Pavement Materials

Aggregates- Origin, Classification, Requirements, properties and tests on Road aggregates, Concepts of size and gradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.
Bitumen and Tar- Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements.

Module-2

Bituminous emulsion and Cutbacks- Preparation, Characteristics, uses and test. Adhesion of bitumen binders to road aggregates, Adhesion failure, Mechanism of stripping, tests and methods of improving adhesion.

Module-3

Bituminous mixes: Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveemstabilo meter and Hubbar- field tests) bituminous mixes, Design methods using Rothfutch's method only and specification, Marshall mix design criteria, voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Problems on above.

Module-4

Equipments in highway construction: Various types of equipments for excavation, grading and compaction- their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.
Sub grade: Earthwork grading and Construction of embankments and cuts for roads, Preparation of subgrade, quality control tests.

Module-5

Flexible Pavements: Specifications of materials, Construction method and field control checks for various types of flexible pavement layers.
Cement Concrete Pavements: Specifications and method of cement concrete pavement construction (PQC, importance of providing DLC as sub base and polythene thin layer between PQC and sub base). Quality control tests, Construction of various types of joints.

Course outcomes: At the end of the course the student will be able to:

1. Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
2. Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
3. Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction.
4. Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Highway Engineering- Khanna, S.K., and Justo, C.E.G.: Nem Chand and Bros. Roorkee.
2. Construction Equipment and its Management- Sharma, S.C.:Khanna Publishers.
3. Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

Reference Books

1. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. Relevant IRC codes and MoRT& H specifications.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

GROUND WATER HYDRAULICS

Course Code	**18CV734**	IA Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	Exam Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students
1. To characterize the properties of ground water and aquifers.
2. To quantify the ground water flow.
3. To locate occurrence of ground water and augment ground water resources.
4. To synthesize ground water development methods.

Module -1

Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.

Module -2

Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, anisotropic layered soils.

Module -3

Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leakyaquifers (only introduction), interference of well, image well theory.

Module -4

Ground Water Exploration: Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.

Module -5

Ground Water Development: Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.

Ground Water Recharge: Artificial recharge, Rainwater harvesting for ground water recharge.

Course outcomes: After studying this course, students will be able to:
1. Find the characteristics of aquifers.
2. Estimate the quantity of ground water by various methods.
3. Locate the zones of ground water resources.
4. Select particular type of well and augment the ground water storage.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.

Reference Books:

1. GargSatyaPrakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

MASONRY STRUCTURES

Course Code	18CV735	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Module-1

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units-strength, modulus of elasticity and water absorption of masonry materials–classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Module-2

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Design Considerations: Effective height of wall sand columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

Module-3

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads –Problems onec centrically loaded solid walls, cavity walls, walls with piers.

Module-5

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.

Introduction to reinforced brick masonry, lintels and slabs.

In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

Course outcomes: After studying this course, students will be able to:

1. Select suitable material for masonry construction by understanding engineering properties.
2. Compute loads, load combinations and analyze the stresses in masonry.
3. Design masonry under compression (Axial load) for various requirements and conditions.
4. Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions.
5. Assess the behavior of shear wall and reinforced masonry.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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Textbooks:

1. Dayaratnam P, "Brick and Reinforced Brick Structures", Scientific International Pvt. Ltd.
2. M. L. Gambhir, "Building and Construction Materials", McGraw Hill education Pvt. Ltd.

Reference Books:

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd.,1990.
2. IS 1905–1987 "Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi.
3. **SP20(S&T)–1991,"Hand book on masonry design and construction(1st revision) BIS, New Delhi.**

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

EARTHQUAKE ENGINEERING

Course Code	**18CV741**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to learn about

1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Module -1

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake).

Module -2

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

Module -3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

Module -4

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

Module -5

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings
Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

Course outcomes: After studying this course, students will be able to:

1. Acquire basic knowledge of engineering seismology.
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry

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structures thorough exposure to different !S-codes of practices.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
2. S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
3. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
4. T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

Reference Books:

1. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

DESIGN CONCEPT OF BUILDING SERVICES

Course Code	**18CV742**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Learn the importance of sanitation, domestic water supply, and plumbing and fire services.
2. Understand the concepts of heat, ventilation and air conditioning.
3. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply and its Services.
Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom–taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit.

Module -2

Heat Ventilation and Air Conditioning (HVAC):
Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

Module -3

Electrical and Fire Fighting Services:
Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice, planning electrical wiring for building, Main and distribution boards, Principles of illumination.
Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Provisions of NBC.

Module -4

Plumbing and Fire Fighting Layout of Simple Buildings:
Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

Module -5

Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.
Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,
Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

Course Outcomes: After studying this course, students will be able to:

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings.

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books:

1. National Building Code.
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & D L Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
4. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
5. M. David Egan, Concepts in Building Fire Safety.
6. O. H. Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom.
7. V. K. Jain, Fire Safety in Building 2edition, New Age International Publishers.
8. E. G. Butcher, Smoke control in Fire-safety Design.
9. E. R. Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York.
10. Handbook for Building Engineers in Metric systems, NBC, New Delhi.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

REINFORCED EARTH STRUCTURES

Course Code	18CV743	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module -1

Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.
Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics.
Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties.

Module -2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems
Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

Module -3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

Module -4

Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes.

Module -5

Geosynthetics - filter, drain and landfills: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anti clogging, survivability and durability (No Numerical Problems)
Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems).

Course outcomes: After studying this course, students will be able to:

1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geo synthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geo synthetics in drainage requirements and landfill designs

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

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- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Koerner. R.M, "Design with Geo synthetics", Prince Hall Publications
2. Koerner. R.M. &Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York,.
3. Sivakumar Babu G. L., "An introduction to Soil Reinforcement and Geo synthetics", Universities Press, Hyderabad
4. Swami Saran, "Reinforced Soil and its Engineering Applications", I. K. International Pvt. Ltd, New Delhi
5. Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, "Engineering with Geo synthetics", Tata McGraw Hill publishing Company Limited., New Delhi.

Reference Books:

1. Jones, "Earth reinforcement and Soil structure", CJEP Butterworths, London
2. Ingold, T.S. & Millar, K.S, "Geotextile Hand Book", Thomas, Telford, London.
3. Hidetoshi Octial, Shigenori Hayshi& Jen Otani, "Earth Reinforcement Practices",Vol. I, A.A. Balkema, Rotterdam
4. Bell F.G, "Ground Engineer's reference Book", Butter worths, London
5. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.
6. Sarsby R W- Editor, "Geo synthetics in Civil Engineering", Wood head Publishing Ltd & CRC Press, 2007

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SEMESTER - VII

DESIGN OF HYDRAULIC STRUCTURES

Course Code	**18CV744**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

CREDITS –03

Course Learning Objectives: This course will enable students to;

1. Analyze and design gravity dams.
2. Find the cross-section of earth dam and estimate the seepage loss.
3. Design spillways and aprons for diversion works.
4. Design CD works and chose appropriate canal regulation works.

Module -1

Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.

Module -2

Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.

Module -3

Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices.
Diversion Headworks: Design of aprons- Bligh's and Koshla's theory, Simple Problems.

Module -4

Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.

Module -5

Canal Regulation Works: Introduction, Function of a regulator.
Canal falls: Necessity and types.
Canal outlets: Necessity and types.

Course outcomes: After studying this course, students will be able to:

1. Check the stability of gravity dams and design the dam.
2. Estimate the quantity of seepage through earth dams.
3. Design spillways and aprons for various diversion works.
4. Select particular type of canal regulation work for canal network.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2. Punmia and Pandey Lal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3. K. R. Arora. "Irrigation, Water Power and Water Resources Engineering" Standard Publications, New Delhi.

Reference Books:

1. R. K. Sharma, "Text Book of Irrigation Engineering and Hydraulic Structures", Oxford and IBH, New Delhi.
2. P. N. Modi, "Irrigation, Water Resources and Water Power", Standard Book House, New Delhi.

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SEMESTER - VII

URBAN TRANSPORT PLANNING

Course Code	**18CV745**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

5. Understand and apply basic concepts and methods of urban transportation planning.
6. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
7. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
8. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

Module -1

Urban transport planning: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

Module -2

Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

Module -3

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above.**

Module -4

Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above.**

Module -5

Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.

Course outcomes: After studying this course, students will be able to:

5. Design, conduct and administer surveys to provide the data required for transportation planning.
6. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
7. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
8. Adopt the steps that are necessary to complete a long-term transportation plan.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

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4. Kadiyali. L. R., 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi.
5. Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
6. Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
7. Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

Reference Books:

3. Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
4. Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
5. Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

FINITE ELEMENT METHOD

Course Code	18CV751	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

Module -1

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.

Module -2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.

Module -3

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisym metric Element.

Module -4

Isopara metric concepts; is opera metric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isopara metric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.

Module -5

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.

Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

Course outcomes: The student will have the knowledge on advanced methods of analysis of structures.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al. "Concepts and applications of Finite Element analysis", John Wiley.

Reference Books:

1. Daryl L Logan, "A first course on Finite element Method", Cengage Learning.
2. Bathe K J - "Finite Element Procedures in Engineering analysis"- Prentice Hall.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

NUMERICAL METHODS AND APPLICATIONS

Course Code	18CV752	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

Module -1

Solution of Equations and Eigen value Problems: Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method.

Module -2

Interpolation and Approximation: Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

Module -3

Numerical Differentiation and Integration: Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

Module -4

Initial Value Problems for Ordinary Differential Equations : Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

Module -5

Boundary Value Problems in Ordinary and Partial Differential Equations:
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

Course Outcomes: After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from Industry, management and other engineering fields.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Grewal. B.S. and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi.

Reference Books:

1. Chapra. S.C. and Canale. R. P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi.
2. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

ENVIRONMENTAL PROTECTION AND MANAGEMENT

Course Code	18CV753	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to gain knowledge in Environmental protection and Management systems

Module -1

Environmental Management Standards: Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

Module -2

Environmental Management Objectives: Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.

Module -3

Environmental Management System: EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

Module -4

Environmental Audit: Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.

Module -5

Applications: Applications of EMS, Waste Audits and Pollution Prevention Control: Textile, Sugar, Pulp & Paper, Electroplating, , Tanning industry. Hazardous Wastes - Classification, characteristics Treatment and Disposal Methods, Transboundary movement, disposal.

Course outcomes: After studying this course, students will be able to:

1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards.
2. Lead pollution prevention assessment team and implement waste minimization options.
3. Develop, Implement, maintain and Audit Environmental Management systems for Organizations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books:

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International

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Organisation for Standardisation, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop ,,Pollution Prevention: Fundamentals and Practice, McGraw- Hill International, Boston, 2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

COMPUTER AIDED DETAILING OF STRUCTURES

Course Code	18CVL76	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Be aware of the Scale Factors, Sections of drawings,
2. Draft the detailing of RC and Steel Structural member.

Module -1 Detailing of RCC Structures

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Welded Plate girder
6. Gantry Girder

Course outcomes: After studying this course, students will be able to:

- Prepare detailed working drawings

Question paper pattern:

1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 50 marks.

Textbooks:

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

Reference Books:

1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards.
2. IS 13920, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - VII

GEOTECHNICAL ENGINEERING LABORATORY

Course Code	**18CVL77**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

Modules

1. Field identification of soil, Specific gravity test (pycnometer and density bottle method).Water content determination by oven drying and Pycnometer method, rapid moisture meter method.
2. Grain size analysis
   i. Sieve analysis
   ii. Hydro meter analysis
3. In-situ density tests
   i. Core-cutter method
   ii. Sand replacement method
4. Consistency limits
   i. Liquid limit test(by Casagrande's and cone penetration method)
   ii. Plastic limit test
   iii. Shrinkage limit test
5. Standard compaction test (light and heavy compaction)
6. Co-efficient of permeability test
   i. Constant head test
   ii. Variable head test
7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (unconsolidated undrained test only)
8. Consolidation test :To determine pre consolidation pressure only(half an hour per loading-test).
9. Laboratory vane shear test
10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

Course outcomes: Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine

1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shearstrengthandconsolidationparameterstoassessstrengthanddeformationcharacteristics
5. In-situshear strength characteristics(SPT-Demonstration)

Question paper pattern:

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him.
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script.

Reference Books:

1. Punmia B C, Soil Mechanics and Foundation Engineering-(2017),16th Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4. BowlesJ.E.,"EngineeringPropertiesofSoilandTheirMeasurements",-McGrawHillBookCo.NewYork.
5. Relevant BIS Codes of Practice: IS-2720 series

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

DESIGN OF PRE-STRESSECONCRETE

Course Code	18CV81	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to learn Design of Pre Stressed Concrete Elements.

Module -1

Introduction and Analysis of Members: Concept of Pre stressing - Types of Pre stressing - Advantages - Limitations –Pre stressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.
Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete – pre stressed concrete - Force concept - Load balancing concept - Kern point -Pressure line.

Module -2

Losses in Pre stress: Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.
Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

Module -3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members.

Module -4

Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

Module -5

Different anchorage system and design of end block by latest IS codes.

Course outcomes: After studying this course, students will be able to:

1. Understand the requirement of PSC members for present scenario.
2. Analyse the stresses encountered in PSC element during transfer and at working.
3. Understand the effectiveness of the design of PSC after studying losses
4. Capable of analyzing the PSC element and finding its efficiency.
5. Design PSC beam for different requirements.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Krishna Raju, N. "Pre stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006
2. Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
3. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi

Reference Books:

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1. Praveen Nagarajan, "Advanced Concrete Design", Person Publishers
2. P. Dayaratnam, "Pre stressed Concrete Structures", Scientific International Pvt. Ltd.
3. Lin T Y and Burns N H. 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York
4. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi
5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.
6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII
BRIDGE ENGINEERING

Course Code	**18CV821**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Note: All designs have to be done by Working Stress Method

Module -1

Introduction to bridges, classification, selection of bridge site and preliminary and detailed survey work computation of discharge, linear waterway, economic span, afflux, scour depth.
Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

Module -2

Design of Slab Bridges: Straight and skew slab bridges.

Module -3

Design of T beam bridges(up to three girder only)
Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

Module -4

Other Bridges:
Design of Box culvert (Single vent only).
Design of Pipe culverts.

Module -5

Substructures - Design of Piers and abutments,
Introduction to Bridge bearings, Hinges and Expansion joints.(No design).

Course outcomes: After studying this course, students will be able to:

1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints and
5. Design Piers and abutments.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

Reference Books:

1. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2.,Nem Chand Brothers.
2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
3. "Concrete Bridges", The Concrete Association of India

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

PREFABRICATED STRUCTURES

Course Code	**18CV822**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand modular construction, industrialized construction
2. Design prefabricated elements.
3. Understand construction methods.

Module -1

Introduction: Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.

Module -2

Prefabricated Components: Behavior of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels–Columns–Shear walls.

Module -3

Design Principles: Disuniting of structures-Design of cross section based on efficiency of material used–Problems in design because of joint flexibility–Allowance for joint deformation.

Module -4

Joint In Structural Members: Joints for different structural connections–Dimensions and detailing–Design of expansion joints.

Module -5

Design For Abnormal Loads: Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

Course Outcomes: After studying this course, students will be able to:

1. Use modular construction, industrialized construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

Reference Books:

1. KonczT.,"Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH,1976.
2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009

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SEMESTER - VIII

ADVANCED FOUNDATION ENGINEERING

Course Code	**18CV823**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course.
2. Develop profound understanding of shallow and deep foundation analyses.
3. Develop understanding of choice of foundation design parameters.
4. Learn about cause and effect of dynamic loads on foundation.

Module -1

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

Module -2

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure.

Module -3

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

Module -4

Well Foundations: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.

Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

Module -5

Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

Course outcomes: After studying this course, students will be able to:

1. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
2. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles.
3. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons.
4. Understand basics of analysis and design principles of machine foundations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Punmia B.C., "Soil Mechanics and Foundation Engineering,Laxmi Publications Co., India.
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India.
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

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Reference Books:

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India.
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India.
4. Braja. M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India.
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

REHABILITATION AND RETROFITTING

Course Code	**18CV824**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Investigate the cause of deterioration of concrete structures.
2. Strategies different repair and rehabilitation of structures.
3. Evaluate the performance of the materials for repair.

Module -1

General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

Module -2

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems.

Module -3

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

Module -4

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building.

Module -5

Materials for Repair and Retrofitting: Artificial fiber reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Course outcomes: After studying this course, students will be able to:

1. Identify the causes for structural (Concrete) deterioration.
2. Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.
3. Recommend maintenance requirements of the buildings and preventive measures against influencing factors.
4. Select suitable material and suggest an appropriate method for repair and rehabilitation.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.

Reference Books:

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1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).
3. CPWD Manual

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B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
PAVEMENT DESIGN			
Course Code	**18CV825**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

Module -1

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.

Module -2

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.

Module -3

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method. Design factors for runway pavements, Design methods for

Airfield pavement and problems on above.

Module -4

Stresses in Rigid Pavement : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above.

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.

Module -5

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.

Course outcomes: After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

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- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky.

Reference Books:

1. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
2. SubhaRao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design", University Press.
4. Relevant recent IRC codes

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B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
PROJECT WORK PHASE-2			
Course Code	**18CVP83**	CIE Marks	40
Teaching Hours/Week(L:T:P)	-	SEE Marks	60
Credits	08	Exam Hours	03

Course objectives:

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes: At the end of the course the student will be able to:

- Describe the project and be able to defend it.
- Develop critical thinking and problem solving skills.
- Learn to use modern tools and techniques.
- Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
- Develop skills to work in a team to achieve common goal.
- Develop skills of project management and finance.
- Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
- Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Evaluation Procedure:

- **As per University guidelines**
- **Internal Marks:** The Internal marks (100 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.
- **Semester End Examination:** SEE marks for the project (100 marks) shall be based on Project report, Presentation and Demonstration of the actual/model/prototype of the project, as per the University norms by the examiners appointed VTU.

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B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

TECHNICAL SEMINAR

Course Code	18CVS84	CIE Marks	100
Teaching Hours/Week(L:T:P)	--	SEE Marks	--
Credits	01	Exam Hours	03

Course Learning Objectives:
The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey; organize the Course topics in a systematic order.

- Conduct literature survey in the domain area to find appropriate topic.
- Prepare the synopsis report with own sentences in a standard format.
- Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation.
- Present the seminar topic orally and/or through power point slides.
- Communicate effectively to answer the queries and involve in debate/discussion.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes: At the end of the course the student will be able to:

- Develop knowledge in the field of Civil Engineering and other disciplines through independent learning and collaborative study.
- Identify and discuss the current, real-time issues and challenges in engineering & technology.
- Develop written and oral communication skills.
- Explore concepts in larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others.
- Develop the skills to enable life-long learning.

Evaluation Procedure:

- As per University guidelines.
- The Internal Assessment marks for the seminar shall be awarded based on the relevance of the seminar topic, quality of the report, presentation skills, participation in the question and answer, and attendance in the seminar classes/sessions.

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B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII			
INTERNSHIP /PROFESSIONAL PRACTICE			
Course Code	18CV185	CIE Marks	40
Teaching Hours/Week(L:T:P)	Industry Oriented	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to get the field exposure and experience

Note: Internship /Professional Practice:

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.
2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions
3. The industry/organization should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.
4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.
5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.
6. The College shall facilitate and monitor the student internship program.
7. The internship should be completed during vacation after VI and VII semesters.

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Sri Shridevi Charitable Trust (R.)
SHRIDEVI INSTITUTE OF ENGINEERING & TECHNOLOGY
ESTD:2002
Sira Road, Tumkur - 572 106, Karnataka, India.
Phone: 0816 - 2212629 | Principal: 0816 - 2212627, 9686114899 | Telefax: 0816 - 2212628
Email: info@shrideviengineering.org, principal@shrideviengineering.org | Website: www.shrideviengineering.org
(Approved by AICTE, New Delhi, Recognised by Govt. of Karnataka and Affiliated to Visvesvaraya Technological University, Belagavi)

Criteria 1.1

Curriculum Planning and Implementation

Syllabus Copy (Civil)

2021 scheme

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

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Scheme of Teaching and Examinations 2021

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 - 22)

III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
				L	T	P	S					
1	BSC 21MAT31	Transform Calculus, Fourior Series and Numerical Techniques (Common to all)	TD- Maths PSB-Maths					03	50	50	100	3
2	IPCC 21CV32	Geodetic Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	IPCC 21CV33	Strength of Materials	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
4	PCC 21CV34	Earth Resources and Engineering	TD: Geology PSB: Geology	3	0	0		03	50	50	100	3
5	PCC 21CVL35	Computer-Aided Building Planning and Drawing	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
6	UHV **21SCR36**	Social Connect and Responsibility	Any Department	0	0	1		01	50	50	100	1
7	HSMC 21KSK37/47 HSMC 21KBK37/47 OR HSMC 21CIP37/47	Samskrutika Kannada Balake Kannada OR Constitution of India and Professional Ethics	TD and PSB HSMC	0	2	0		01	50	50	100	1
8	AEC 21CV38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course: 0 If offered as lab. course: 0	2 0	0 2		01 02	50	50	100	1
								Total	400	400	800	18

Sl. No		Course Code	Course Title	TD	
9	Scheduled activities for III to VIII semesters	NCMC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE)(Sports and Athletics), and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semester to VIII semester (for 5 semesters). SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities.
		NCMC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NCMC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

Sl. No	Course Code	Course Title	TD	L	T	P	S	Duration	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.

L –Lecture, **T** – Tutorial, **P**- Practical/ Drawing, **S** – Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination.**TD**- Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2021-22 may be

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referred.

21INT49Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A)Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE, nd 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III			
21CV381	Problem Solving using Python	21CV384	Infrastructure Finance
21CV382	Microsoft Excel and Visual Basic for Application	21CV385	Fire Safety in Buildings
21CV383	Personality Development and Soft Skills		

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture L	Tutorial T	Practical/ Drawing P	Self-Study S	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC **21MAT41**	Complex Analysis, Probability and Statistical Methods.	TD, PSB-Maths					03	50	50	100	3
2	IPCC 21CV42	Fluid Mechanics and Hydraulics	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	IPCC 21CV43	Public Health Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
4	PCC 21CV44	Analysis of Structures	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology for Engineers	BT, CHE, PHY	1	2	0		02	50	50	100	2
6	PCC 21CVL46	Earth Resources and Engineering Lab	TD: Geology PSB: Geology	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	0	2	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21CV48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course: 0	2	0		01	50	50	100	1
				If offered as lab. course: 0	0	2		02				
9	UHV 21UH49	Universal Human Values	Any Department	0	2	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
								Total	550	450	1000	22

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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Non – credit mandatory course (NCMC):

Additional Mathematics - II:

(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses. Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV			
21CV481	Data Cleaning and Preparation with Python Pandas	21CV484	Project Finance
21CV482	GIS with Quantum GIS	21CV485	Green Buildings
21CV483	Technical Writing Skills		

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societal Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete it subsequently after satisfying the internship requirements.

(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprises (MSME), Innovation centres, or Incubation centers etc. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.

Entrepreneurship internships offer a chance to gain hands-on experience in the world of entrepreneurship and help to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavors. Start-ups and small companies are a preferred places to learn the business tactics for future entrepreneurs as earning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open minds to creativity and innovation. Entrepreneurship internships can be from several sectors, including technology, small and medium-sized sector, and the service sector.

(3) Societal or Social internship. Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoys. The rural internship is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

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(Effective from the academic year 2021 - 22)

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self-Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	21MAT31	Transform Calculus, Fourier Series and Numerical Techniques (Common to all)	TD- Maths PSB-Maths					03	50	50	100	3
2	IPCC	21CV32	Geodetic Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	IPCC	21CV33	Strength of Materials	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
4	PCC	21CV34	Earth Resources and Engineering	TD: Geology PSB: Geology	3	0	0		03	50	50	100	3
5	PCC	21CVL35	Computer-Aided Building Planning and Drawing	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
6	UHV	**21SCR36**	Social Connect and Responsibility	Any Department	0	0	1		01	50	50	100	1
7	HSMC	21KSK37/47	Samskrutika Kannada	TD and PSB HSMC	0	2	0		01	50	50	100	1
	HSMC	21KBK37/47	Balake Kannada										
			OR										
	HSMC	21CIP37/47	Constitution of India and Professional Ethics										
8	AEC	21CV38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course				01	50	50	100	1
					0	2	0						
					If offered as lab. course				02				
					0	0	2						
									Total	**400**	**400**	**800**	**18**

Sl. No		Course and Course Code	Course Title	TD	Description
9	Scheduled activities for III to VIII semesters	NCMC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE)(Sports and Athletics), and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semester to VIII semester (for 5 semesters). SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities.
		NCMC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NCMC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

Sl. No	Course and Course Code	Course Title	TD	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.

L –Lecture, T – Tutorial, P- Practical/ Drawing, **S** – Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD**- Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2021-22 may be

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referred.

21INT49Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A)Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE, nd 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III			
21CV381	Problem Solving using Python	21CV384	Infrastructure Finance
21CV382	Microsoft Excel and Visual Basic for Application	21CV385	Fire Safety in Buildings
21CV383	Personality Development and Soft Skills		

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC **21MAT41**	Complex Analysis, Probability and Statistical Methods.	TD, PSB-Maths					03	50	50	100	3
2	IPCC 21CV42	Fluid Mechanics and Hydraulics	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	IPCC 21CV43	Public Health Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
4	PCC 21CV44	Analysis of Structures	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology for Engineers	BT, CHE, PHY	1	2	0		02	50	50	100	2
6	PCC 21CVL46	Earth Resources and Engineering Lab	TD: Geology PSB: Geology	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47 HSMC 21KBK37/47 OR HSMC 21CIP37/47	Samskrutika Kannada Balake Kannada OR Constitution of India & Professional Ethics	HSMC	0	2	0		01	50	50	100	1
8	AEC 21CV48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course 0 If offered as lab. course 0	 2 0	 0 2		01 02	50	50	100	1
9	UHV 21UH49	Universal Human Values	Any Department	0	2	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
								Total	**550**	**450**	**1000**	**22**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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Non – credit mandatory course (NCMC):

Additional Mathematics - II:

(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses. Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV			
21CV481	Data Cleaning and Preparation with Python Pandas	21CV484	Project Finance
21CV482	GIS with Quantum GIS	21CV485	Green Buildings
21CV483	Technical Writing Skills		

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societal Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete it subsequently after satisfying the internship requirements.

(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprises (MSME), Innovation centres, or Incubation centers etc. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.

Entrepreneurship internships offer a chance to gain hands-on experience in the world of entrepreneurship and help to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavors. Start-ups and small companies are a preferred places to learn the business tactics for future entrepreneurs as earning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open minds to creativity and innovation. Entrepreneurship internships can be from several sectors, including technology, small and medium-sized sector, and the service sector.

(3) Societal or Social internship. Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoys. The rural internship is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21CV51	Hydrology and Water Resources Engineering	TD: Civil Engg PSB: Civil Engg	3	0	0		03	50	50	100	3
2	IPCC 21CV52	Transportation Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	PCC 21CV53	Design of RC Structural Elements	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
4	PCC 21CV54	Geotechnical Engineering	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
5	PCC 21CVL55	Geotechnical Engineering Lab	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
6	AEC 21CV56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	1	2	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	0	2	0		1	50	50	100	1
8	AEC 21CV58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100	1
				0	2	0						
				If offered as lab. courses				02				
				0	0	2						
								Total	400	400	800	18

Ability Enhancement Course - V

21CV581	Data Analysis with Python	21CV584	Quality Control and Quality Assurance
21CV582	Software Applications	21CV585	Offshore Structures
21CV583	Gender Sensitization		

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMC	21CV61	Construction Management and Entreprenurship	TD: Civil Engg PSB: Civil Engg	3	0	0		03	50	50	100	3
2	IPCC	21CV62	Concrete Technology	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	PCC	21CV63	Design of Steel structure	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
4	PEC	21CV64x	Professional Elective Course-I	TD: Civil Engg PSB: Civil Engg					03	50	50	100	3
5	OEC	21CV65x	Open Elective Course-I	Concerned Department					03	50	50	100	3
6	PCC	21CVL66	Computer Aided Detailing of Structure	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
7	MP	21CVMP67	Mini Project	TD: Civil Engg PSB: Civil Engg	Two contact hours /week for interaction between the faculty and students.				--	100	--	100	2
8	INT	21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100	3
									Total	**500**	**300**	**800**	**22**

Professional Elective - I

21CV641	Design of Prestressed Concrete Structures	21CV644	Design Concept in Building Services
21CV642	Applied Geotechnical Engineering	21CV645	Ground Water Hydraulics
21CV643	Railways, Harbors, Tunneling and Airports	21CV646	Alternative Building Materials

Open Electives – I offered by the Department to other Department students

21CV651	Remote Sensing and GIS	21CV653	Occupational Health and Safety
21CV652	Traffic Engineering	21CV654	Conservation of Natural Resources

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, OEC–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, **T** – Tutorial, **P** - Practical / Drawing, **S** – Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses(PEC):

A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall **not be allowed** if,

(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course, under any category, is prescribed in the higher semesters of the program.

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In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Class work and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	21CV71	Quantity Survey and Contract Management	TD: Civil Engg PSB: Civil Engg	2	2	0		3	50	50	100	3
2	PCC	21CV72	Construction Technology for Substructure and Super Structures	TD: Civil Engg PSB: Civil Engg	2	0	0		3	50	50	100	2
3	PEC	21CV72X	Professional elective Course-II	TD: Civil Engg PSB: Civil Engg					3	50	50	100	3
4	PEC	21CV73X	Professional elective Course-III	TD: Civil Engg PSB: Civil Engg					3	50	50	100	3
5	OEC	21CV74X	Open elective Course-II	Concerned Department					3	50	50	100	3
6	Project	21CVP75	Project work	TD: Civil Engg PSB: Civil Engg	Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
									Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	Seminar	21CV81	Technical Seminar	TD: Civil Engg PSB: Civil Engg	One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT	21INT82	Research Internship/ Industry Internship	TD: Civil Engg PSB: Civil Engg	Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester toVIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21CV721	Advanced Design of RCC and Steel Structures	21CV724	Solid Waste Management
21CV722	Advanced Geotechnical Engineering	21CV725	Design of Hydraulic Structures
21CV723	Pavement Materials and Construction	21CV726	Repair, Retrofitting and Rehabilitation of Structures

Professional Elective - III

21CV731	Earthquake Engineering	21CV734	Air Pollution and Control
21CV732	Ground Improvement Techniques	21CV735	Open Channel Hydraulics
21CV733	Pavement Design	21CV736	Design of Masonry Structures

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Open Electives - II offered by the Department to other Department students			
21CV741	Finite Element Method	21CV744	Intelligent Transportation Systems
21CV742	Numerical Methods and Applications		
21CV743	Environmental Protection and Management		

Note: PCC: Professional Core Course, PEC: Professional Elective Courses, OEC–Open Elective Course, AEC –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

PROJECT WORK (21XXP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for the exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the program of Specialization.

(i) Carry out a literature survey, and systematically organize the content. **(ii)** Prepare the report with your own sentences, avoiding a cut and paste act. **(iii)**Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. **(iv)** Present the seminar topic orally and/or through PowerPoint slides. **(v)** Answer the queries and involve in debate/discussion. **(vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks. ■ No SEE component for Technical Seminar

Non–credit mandatory courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE, 35 % or more marks in SEE, and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum program period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of a degree.

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B. E. (Common to all branches)

Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES			
Course Code	**21MAT 31**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives: The goal of the course Transform Calculus, Fourier series and Numerical techniques 21MAT 31 is

- To have an insight into solving ordinary differential equations by using Laplace transform techniques
- Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis.
- To enable the students to study Fourier Transforms and concepts of infinite Fourier Sine and Cosine transforms and to learn the method of solving difference equations by the z-transform method.
- To develop proficiency in solving ordinary and partial differential equations arising in engineering applications, using numerical methods

Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution for some exercises (post-lecture activity).

Module-1: Laplace Transform

Definition and Laplace transforms of elementary functions (statements only). Problems on Laplace's Transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of Periodic functions (statement only) and unit-step function – problems.
Inverse Laplace transforms definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) problems. Laplace transforms of derivatives, solution of differential equations. **(8 Hours)**

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Self-study: Solution of simultaneous first-order differential equations. **(RBT Levels: L1, L2 and L3)**	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-2: Fourier Series	
Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis. **(8 Hours)** **Self-study:** Convergence of series by D'Alembert's Ratio test and, Cauchy's root test. **(RBT Levels: L1, L2 and L3)**	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-3: Infinite Fourier Transforms and Z-Transforms	
Infinite Fourier transforms definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Problems. Difference equations, z-transform-definition, Standard z-transforms, Damping and shifting rules, Problems. Inverse z-transform and applications to solve difference equations. **(8 Hours)** **Self Study**: Initial value and final value theorems, problems. **(RBT Levels: L1, L2 and L3)**	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-4: Numerical Solution of Partial Differential Equations	
Classifications of second-order partial differential equations, finite difference approximations to derivatives, Solution of Laplace's equation using standard five-point formula. Solution of heat equation by Schmidt explicit formula and Crank- Nicholson method, Solution of the Wave equation. Problems. **(8 Hours)** **Self Study**: Solution of Poisson equations using standard five-point formula. **(RBT Levels: L1, L2 and L3)**	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-5: Numerical Solution of Second-Order ODEs and Calculus of Variations	
Second-order differential equations - Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae). Calculus of Variations: Functionals, Euler's equation, Problems on extremals of functional. Geodesics on a plane, Variational problems. **(8 Hours)** **Self Study:** Hanging chain problem **(RBT Levels: L1, L2 and L3)**	
Course outcomes: After successfully completing the course, the students will be able : ➢ To solve ordinary differential equations using Laplace transform. ➢ Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. ➢ To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations ➢ To solve mathematical models represented by initial or boundary value problems involving partial differential equations ➢ Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.	

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

First test at the end of 5th week of the semester

Second test at the end of the 10th week of the semester

Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

First assignment at the end of 4th week of the semester

Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books

1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.
2. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co.Newyork, Latest ed.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education(India) Pvt. Ltd 2015.
6. **H.K.Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication (2014).
7. **James Stewart:** "Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

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Web links and Video Lectures (e-Resources):

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- http://www.bookstreet.in.
- VTU e-Shikshana Program
- VTU EDUSAT Program

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Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
• Quizzes • Assignments • Seminars

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III Semester

Geodetic Engineering			
Course Code	**21CV32**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:2:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	03

Course objectives:

- Provide basic knowledge about principles of surveying for location, design and construction of engineering projects
- Develop skills for using surveying instruments including, levelling instruments, plane tables, theodolite, compass
- Make students to familiar with cooperative efforts required in acquiring surveying data and applying fundamental concepts to eliminate errors and set out the works
- Provide information about new technologies that are used to abstracting the information of earth surface

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. The survey of India topomap has to be shared with students and few exercise must be given
2. The satellite imagery has to be procured and shared with students
3. The manual for conducting field survey has to be provided
4. The online courses available should be shared with students
5. YouTube videos
6. Power point presentations

Module-1

Introduction to Surveying: Importance of surveying in Civil Engineering, Concepts of plane and geodetic surveying Principles of surveying –Plans and maps – Surveying equipment's, Meridians, Bearings, Dip, Declination, Local attraction, Calculation of bearings and included angles. Compass surveying and Plane Table Surveying

Compass surveying: Prismatic and surveyor's compasses, temporary adjustments.

Plane Table Surveying: plane table and accessories, advantages and disadvantages of plane table survey, method of plotting - radiation, intersection, traversing, resection, two point and three point method

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-2

Levelling – Principles and basic definitions – Types of Levels – Types of adjustments and objectives – Types of levelling – Simple, Differential, Fly, Reciprocal, Profile, Cross sectioning – Booking of levels – Rise & fall and H. I methods (Numerical)

Areas and volumes: Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpsons one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes-trapezoidal and prismoidal formula.

Teaching-Learning	Chalk and talk, PowerPoint Presentation, YouTube videos

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Process	

Module-3

Theodolite Surveying: Theodolite and types, fundamental axes and parts of theodolite, temporary adjustments of transit theodolite. Horizontal and Vertical angle measurements by repetition and reiteration Trigonometric levelling: Single and Double plane for finding elevation of objects Computation of distances and elevations using Tacheometric method.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-4

Curve Surveying: Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankine's deflection angle method (numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics, numerical problems on Length of Transition curve, Vertical curves –Types – (theory).

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-5

Photogrammetry and aerial survey: Introduction, definitions, basics principles, methods, importance of scale, height, applications.

Remote sensing: Introduction, Principle of Remote sensing, EMR, types, resolutions, types of satellites, type of sensors, LIDAR, visual and digital image processing and its applications. **Global Positioning System:** Definition, Principles of GPS and applications. Geographical Information System: Introduction and principle of Geographical Information System, components of GIS, applications

Advanced instrumentation in surveying: classification, measuring principles, Electronic theodolite, EDM, Total Station, Drones

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

LABORATORY EXPERIMENTS

1.	Study of various instruments used for surveying, namely chain, tape, Compass,
2.	Dumpy level, Auto-level, Theodolite, Tacheometer, Total station and GPS. To find the distance between two points shown in the field using method of pacing, chaining and taping.
3.	To set regular geometric figures (Hexagon and Pentagon) using chain tape and accessories.
4.	To set regular geometric figures (Hexagon and Pentagon) using prismatic compass, given the bearing of one line.
5.	Study of use of Dumpy level and to determine the different in elevation between two points by differential levelling using Dumpy level
6.	To find the true difference in elevation between two points situated far apart by using Reciprocal levelling.

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7.	Trigonometrical levelling: Single plane method and Double plane method
8.	Measurement of horizontal angle using theodolite by: i) Method of Repetition and ii) Reiteration method.
9.	Setting simple circular curve-Instrumental method.
10.	Setting compound curve using theodolite
11.	Plane table : Setting, orientation, radiation, intersection
12.	Demo: Total station, GPS

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Execute survey using compass and plane table
2. Find the level of ground surface and Calculation of area and volumes
3. Operate theodolite for field execution
4. Estimate the capacity of reservoir
5. Interpret satellite imageries

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Surveying & levelling Vol. I ,II & III, B. C. Punmia, Laxmi Publications; seventeenth edition (2016)
2. Advanced Surveying: Total Station, GPS, GIS & Remote Sensing by Pearson 2017 by GopiSatheesh, R.Sathikumar, N. Madhu
3. Surveying Vol.I& II, S. K. Duggal, McGraw Hill Education; Fourth edition (2017)

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4. Surveying and Levelling, R. Subramanian , second edition, 2012, Oxford University Press;
5. Engineering Surveying, Schofield and Breach, 6th edition, Butterworth-Heinemann (Elsevier publication, 2007)
6. Surveying , A Banister, S Raymond, R Baker, 7th edition, Pearson , New Delhi

Web links and Video Lectures (e-Resources):

- NPTEL courses

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

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III Semester

STRENGTH OF MATERIALS			
Course Code	21CV33	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2+2+2+0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	03 hrs

Course objectives: This course will enable students

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To determine slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Simple Stresses and Strains: Introduction, Properties of Materials, Stress, Strain, Hook's law, Poisson's Ratio, Stress – Strain Diagram for structural steel, Principles of superposition, Total elongation of tapering bars of circular and rectangular cross sections. Composite section, Volumetric strain, expression for volumetric strain, Elastic constants, relationship among elastic constants (No Numerical), Thermal stress and strains

Compound stresses: Introduction, Stress components on inclined planes, General two-dimensional stress system, Principal planes and stresses, maximum shear stresses and their planes (shear planes). Compound stress using Mohr's circle method.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Bending moment and shear force diagrams in beams: Definition of shear force and bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, development of Shear Force Diagram(SFD) and Bending Moment Diagram (BMD) with salient values for cantilever, simply supported and overhanging beams for point loads, UDL(Uniformly Distributed Load), UVL(Uniformly Varying Load) and Couple.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

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Bending stress in beams: Introduction – Bending stress in beam, Pure bending, Assumptions in simple bending theory, derivation of Simple bending equation (Bernoulli's equation), modulus of rupture, section modulus, Flexural rigidity, Problems

Shear stress in beams: Derivation of Shear stress intensity equations, Derivation of Expressions of the shear stress intensity for rectangular, triangular and circular cross sections of the beams. Problems on calculation of the shear stress intensities at various critical levels of T, I and Hollow rectangular cross sections of the beam.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-4

Torsion: Twisting moment in shafts, simple torque theory, derivation of torsion equation, tensional rigidity, polar modulus, shear stress variation across solid circular and hollow circular sections, Problems

Thin cylinders: Introduction: Longitudinal, circumferential (hoop) stress in thin cylinders. Expressions for longitudinal and circumferential stresses. Efficiency of longitudinal and circumferential joints. Problems on estimation of change in length, diameter and volume when the thin cylinder subjected to internal fluid pressure.

Thick cylinders: Concept of Thick cylinders Lame's equationsapplicable to thick cylinders with usual notations, calculation of longitudinal, circumferential and radial stresses – simple numerical examples. Sketching the variation of radial stress (pressure) and circumferential stress across the wall of thick cylinder. U

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-5

Elastic stability of columns: Introduction – Short and long columns, Euler's theory on columns, Effective length, slenderness ratio, radii of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different boundary conditions, Limitations of Euler's theory, Rankine's formula and related problems.

Deflection of determinate Beams: Introduction, Elastic curve –Derivation of differential equation of flexure, Sign convention, Slope and deflection using Macaulay's method for statically determinate beams subjected to various vertical loads, moment, couple and their combinations. Numerical problems.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

LABORATORY

1. Dimensionality of bricks, Water absorption, Initial rate of absorption
2. Specific gravity of coarse and fine aggregate
3. Fineness modulus of Fine and Coarse aggregate
4. Compressive strength tests on building blocks (brick, solid blocks and hollow blocks)
5. Tension test on Mild steel and HYSD bars
6. Compression test on HYSD, Cast iron
7. Bending Test on Wood under two-point loading.

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8. Shear Test on Mild steel – single and double shear

9. Impact test on Mild Steel (Charpy& Izod)

Course outcome (Course Skill Set)

After completion of the course, students will be able to

1. Evaluate the behaviour when a solid material is subjected to various types of forces (namely Compressive, Tensile, Thermal, Shear, flexure, Torque, internal fluid pressure) and estimate stresses and corresponding strain developed. (L3)

2. Estimate the forces developed and draw schematic diagram for stresses, forces, moments for simple beams with different types of support and are subjected to various types of loads (L3).

3. Evaluate the behaviour when a solid material is subjected to Torque and internal fluid pressure and estimate stresses and corresponding strain developed. (L3)

4. Distinguish the behaviour of short and long column and calculate load at failure & explain the behaviour of spring to estimate deflection and stiffness (L3)

5. Examine and Evaluate the mechanical properties of various materials under different loading conditions

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

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1.Timoshenko and Young, "Elements of Strength of Materials" ,EastWest Press, 5t edition 2003

2.R. Subramanyam, "Strength of Materials", Oxford University Press, 3rd Edition -2016

3.B.C Punmia Ashok Jain, Arun Jain, "Strength of Materials", Laxmi - 2018-22 Publications, 10th Edition-2018

Web links and Video Lectures (e-Resources):

1.Strength of Materials web course by IIT Roorkee https://nptel.ac.in/courses/112107146/

2.Strength of Materials video course by IIT Kharagpur https://nptel.ac.in/courses/105105108/

3.Strength of Materials video course by IIT Roorkee https://nptel.ac.in/courses/112107147/18

4.All contents organized http://www.nptelvideos.in/2012/11/strengthof-materials-prof.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quizz(To assist in GATE Preparations
- Demonstrations in Lab
- Self Study on simple topics
- Simple problems solving using Excel
- Virtual Lab Experiments

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Semester III

: Earth Resources and Engineering			
Course Code	21CV34	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- This course will enable students;

1. To understand the importance of earth's dynamic interior in civil engineering and Geo Hazard mitigation and management
2. To analyse the physical characteristics of the rocks and Minerals for its suitable application in Engineering
3. To evaluate earth Process for providing sustainable management and Development through Geoengineering.
4. Subsurface Exploration for providing safe and suitable site condition and Earth Resources for Reengineering activities
5. To application of modern tools and techniques in Earth Resources Management and.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and Talk method.
2. Show Video/animation films to explain earth dyanamics and influence of geology in prime civil constructions
4. Encourage collaborative (Group Learning) Learning in the class
5. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking process such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Topics will be introduced in a multiple representation.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Module /unit – 01 – Introduction, scope of earth science in Engineering, 8 hrs
Geohazards and disasters, Mitigation and management

Earths internal dynamics ,Plate tectonics, Earth quakes types, causes iso-seismal line, seismic zonation map, seismic proof structures, Numerical problems on location of epicenter; volcanic eruption, types, causes, ; landslides, causes types, preventive measures; tsunamis causes consequences, mitigation;cyclones, causes management

Teaching-Learning Process	• chalk and talk method, • power point presentation. • Case studies • Field visits

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Module-2	
Earth Resources **8hrs** Minerals -Industrial, rock forming and ore minerals. Physical properties, composition and uses Rocks as a construction materials- physical properties, texture, composition, applications for aggregate, decorative (facing/polishing), railway ballast, rocks for masonry work, monumental/architecture, rocks as aquifers, water bearing properties igneous, sedimentary	
Teaching-Learning Process	• Chalk and talk method, • Power point presentation and Animated vedeos • Case studies • Field visits experience the real world examples
Module-3	
Surface investigation for Civil Engineering projects **8hrs** Weathering, type, causes, soil insitu, drifted soil, soil profile, soil mineralogy , structure, types of soil, Black cotton soil v/s Lateritic soil; effects of weathering on monumental rocks, River morphology and basin investigation for engineering Projects like earthen dam, gravity dam, arch dam, features of river erosion, deposition and their influences on river valley projects, morphometric analysis of river basin, selection of site for artificial recharge,, interlinking of river basins, coastal process and landforms, sedimentation /siltation, erosion	
Teaching-Learning Process	• Chalk and talk method, • Power point presentation and Animated vedeos • Case studies • Field visits experience the real world examples

Module-4	
Subsurface investigation for deep foundation **8hrs** Borehole data(and problems), Dip and strike, and outcrop problems(numerical problem geometrical/ simple trigonometry based), Electrical Resistivity meter, depth of water table, (numerical problems) seismic studies, faults, folds, unconformity, joints types, recognitionand their significance in Civil engineering projects like tunnel project, dam project, , Ground improvements like rock bolting, rock jointing, grouting	
Teaching-Learning Process	• Chalk and talk method, • Power point presentation and Animated vedeos • Case studies • Field visits experience the real world examples
Module-5	
Geo-tools and techniques for civil Engineering Applications **7hrs** Toposheets , Remote sensing and GIS. Photogrammetry (scale, flight planning, overlap, elevation effects, interpretation keys, numericals on flight, planning scale , elevation, flyimg height, ….), GPS,, Ground Penetrating Radas (GPR), Drone, and their applications	

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Teaching-Learning Process	• Chalk and talk method, • Power point presentation and Animated vedeos • Case studies • Field visits and research institutes experience the real world examples

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Apply geological knowledge in different civil engineering practice.

2. Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials.

3. competent enough to provide services for the safety, stability, economy and life of the structures that they construct

. 4. Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems

. 5. Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering for safe and solid construction.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of 20 **Mark (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored out of 100, shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=aTVDiRtRook&list=PLDF5162B475DD915F
- https://www.youtube.com/watch?v=EBiLLJAxBuU&index=2&list=PLDF5162B475DD915F
- https://www.youtube.com/watch?v=sTY-ao4RZck&list=PLDF5162B475DD915F&index=3
- https://nptel.ac.in/courses
- https://youtu.be/fvoYHzAhvVM
- https://youtu.be/aTVDiRtRook

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- https://www.earthsciweek.org/classroom-activities
- Field Visits
- https://serc.carleton.edu/NAGTWorkshops/hazards/events/12262004.html?serc_source=recommendation
- https://serc.carleton.edu/NAGTWorkshops/visualization/examples/CBezanson.html?serc_source=recommendation
- https://serc.carleton.edu/NAGTWorkshops/coursedesign/goalsdb/14712.html

Textbooks -

1. Engineering Geology, by Parthasarathy et al, Wiley publications
2. A textbook of Engineering Geology by Chenna Kesavulu, Mac Millan India Ltd
3. Principle of Engineering Geology, by K.M. Bangar, Standard publishers
4. Physical and Engineering Geology, by S.K. Garg, Khanna publishers
5. Principles of Engineering Geology, by KVGK Gokhale, BS Publications

Reference books –

1. Introduction to Environmental Geology by Edward A Keller, Pearson publications.
2. Engineering Geology and Rock Mechanics B. P. Verma, Khanna publishers
3. Principles of Engineering Geology and Geotechnics, Krynine and Judd, CBS Publications

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COMPUTER AIDED BUILDING PLANNING AND DRAWING

Course Code	**21CVL35**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0+0+2+0	SEE Marks	50
Credits	01	Exam Hours	03 hrs

Course objectives:

Provide students with understanding

1. Gain skill set to prepare Computer Aided Engineering Drawings
2. Understanding the details of construction of different building elements
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings
4. Get familiarization of practices used in Industry

Sl.NO	Experiments
	Module 1
1	**Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS:962.
2	**Simple Engineering Drawings with CAD** Drawing Tools: Lines Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing Toolbars, Working with multiple drawings.
	Module 2
3	**Drawings of Different Building Elements:** Following drawings are to be prepared for the data given using CAD Software a) Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings. b) Different types of bonds in brick masonry. c) Different types of staircases – Dog legged, Open well, d) Lintel and chajja. e) RCC Slabs and beams. f) Cross section of a pavement. g) Septic Tank and sedimentation Tank. h) Layout plan of Rainwater recharging and harvesting system. i) Cross sectional details of a road for a Residential area with provision for all services. j) Steel truss (connections Bolted). **Note:**Students should sketch to dimension the above in a sketch book before doing the computer drawing.

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Module 3	
4	**Building Drawings :** Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC. Drawing of plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for 1. Single and double story residential building. 2. Hostel building. 3. Hospital building. 4. School building. Submission drawing (sanction drawing)of two storied residential building with access to terrace including all details and statements as per the local bye-laws Industry Applications : 3D Modelling and Rendering, 2D Animation, Construction site Simulation **Note:** . Students should sketch to dimension the above in a sketch book before doing the computer drawing . One compulsory field visit/exercise to be carried out. . Single line diagrams to be given in the examination.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Prepare, read and interpret the drawings in a professional set up.
2. Know the procedures of submission of drawings and Develop working and submission drawings for building.
3. Plan and design of residential or public building as per the given requirements.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly

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by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Question paper pattern:

- There will be four full questions with sub divisions if necessary from Module2 with each full question carrying twenty five marks. Students have to answer any two questions.
- There will be two full questions from Modulus 3 with each full question carrying fifty marks. Students have to answer any one question. The conduction of examination and question paper format of should be in line of 1st year CAED drawing. It's drawing paper but the exam will be conducted by batches in the computer labs. Question paper should be given in batches.

Suggested Learning Resources:

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Textbook:

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata McGraw Hill Publishing co. Ltd, New Delhi.
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik RS and a Meo GS, "Civil Engineering Drawing", Asian Publishers/Computech Publication Pvt Ltd

Reference Books:

1. Time Saver Standard by Dodge F.W, F.W Dodge Corp.
2. IS: 962-1989 (Code of practice for architectural and building drawing).
3. National Building Code, BIS, New Delhi.

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Semester III

Problem Solving with Python			
Course Code	21CV381	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	1 hr

Course objectives:

- To understand why Python is a useful scripting language for developers.
- To read and write simple Python programs
- To learn how to identify Python object types.
- To learn how to write functions and pass arguments in Python.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Python: Installing Python and Python packages, Managing virtual environments with venv module

Introduction to NumPy arrays:Array creation, indexing, data types, broadcasting, copies and views, universal functions, I/O with NumPy

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-2

Introduction to NumPy and SciPy:NumPy subpackages– linalg, fft, random, polynomials, SciPy subpackages– linalg, fftpack, integrate, interpolate, optimize

Introduction to Matplotlib: Plotting 2D graphs with Matplotlib, annotations, legend, saving plots to file, bar and pie charts, line plots.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-3

Linear algebra using NumPy and SciPy:Solving linear simultaneous equations using NumPy and SciPy using numpy.linalg and scipy.linalg – solve, inverse, determinant, least square solution,

Linear algebra using NumPy and SciPy (continued): Decomposition using lu and cholesky.

Solving eigenvalue problems using NumPy and SciPy:Using numpy.linalg and scipy.linalg – eig, eigvals.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

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Module-4	
Solving initial value problems for ODE systems using scipy.integrate subpackage – solve_ivp, RK45, LSODA. Numerical integration of functions using SciPy:Using scipy.integratesubpackage– Definite integral using Gaussian quadrature – quad and quadrature Numerical integration of fixed samples using scipy.integratesubpackage– Trapezoidal rule trapezoid, Simpson's 1/3 rule using Simpson, Romberg integration romb.	
Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos
Module-5	
Determining roots of equations using SciPyusing scipy.optimizesubpackage– Bisection method bisect, Brent's method brentq, Newton-Raphson method newton. Symbolic computing using SymPy and solving civil engineering problems using SymPy: Introduction, defining symbols, derivatives, integrals, limits, expression evaluation, expression simplification, solving equations, solving differential equations.	
Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Represent compound data using Python lists, tuples, Strings, dictionaries.
4. Read and write data from/to files in Python Programs

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be scaled down to 50 marks

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. R. Nageswara Rao, "Core Python Programming", dreamtech

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2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
3. Python Programming , Reema theraja, OXFORD publication

Web links and Video Lectures (e-Resources):

1. NumPy documentation at https://numpy.org/doc/
2. SciPy documentation at https://docs.scipy.org/doc/scipy/
3. Matplotlib documentation at https://matplotlib.org/stable/users/index
4. SymPy documentation at https://docs.sympy.org/latest/index.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Real world problem solving: Demonstration of projects developed using python language

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Semester III

Microsoft Excel and Visual Basic for Applications			
Course Code	21CV382	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	01 hr

Course objectives:

- To learn basic operations using excel
- To solve problems using functions in excel
- To design structural elements using excel and VB as a tool

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The online courses available should be shared with students
2. YouTube videos
3. Power point presentations
4. Assignments to solve all the problems using excel and VB.

Module-1

Introduction to Microsoft Excel, Workbooks, Worksheets, User Interface – navigating the interface, entering data, implicit data types, setting cell data types, Basic operations – copy/cut, paste, paste special, row and cell references, using cell names, Simple built-in formulae, Copying and pasting formulae

Built-in formulae – Trigonometric, Logarithmic, Exponential, Statistical, Matrix operations such as transpose, multiplication, inverse etc.

Plotting charts of different types, bar and pie charts, scatter plots, legend, Using Log and Semilog scales, Customizing chart axes, Using multiple axes, Preparing contour plots, Annotating charts.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-2

Introduction to Visual Basic for Applications, User Interface – VBA Editor, VBA toolbar, Developing simple functions in VBA – area of a circle, minimum cover to reinforcement in a beam as per IS 456, Calling user defined functions, Organizing code into modules.

Debugging VBA code using built-in debugger – breakpoints, watch variables, trace lines of code with run to cursor, step into, step over and step out.

Developing subroutines, calling subroutines, Differences between functions and subroutines, Scope of subroutines – Public and Private, Calling a subroutine

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-3

VBA data types, Working with data types, Enforcing defining types with Option Explicit, Defining, initializing and using arrays within functions/subroutines.

Commenting code, Long statements spanning multiple lines, Program flow control – Branching and looping, using conditional statements, Calling Worksheet functions in VBA.

Develop functions for simple civil engineering applications – Stability of gravity dams, analysis of

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rectangular footings subjected to axial compression and bending about both axes, etc.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-4

Table lookup – Lookup, Vlookup, Hlookup, Match, Index, VBA Object model, creating and using user defined objects.

Building forms, triggering subroutines by pressing a button on a form

Interacting with other applications with support for VBA, such as, SAP2000/ETABS or any other software used by civil engineers.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-5

Using Python to manipulate Microsoft Excel files, creating, editing and saving Microsoft Excel files from Python, Interacting with Microsoft Excel using Python xl wings package, Calling Python from VBA.

Developing functions and subroutine for a comprehensive civil engineering application – RC design, Steel design, or other similar problems from other fields of Civil Engineering.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Solve Trigonometric, Logarithmic, Exponential, Statistical problems and perform Matrix operations
2. Solve civil engineering problems using VB as a tool
3. Design structural elements by integrating excel and VB

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

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1. The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be scaled down to 50 marks
2. Semester End Examinations (SEE)
3. SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Bourg, D.M., Excel Scientific and Engineering Cookbook, O'Reilly Media Inc., 2006.
2. Bilio, E.J., Excel for Scientists and Engineers – Numerical Methods, Wiley-Interscience, 2007.
3. Documentation for xlwingshttps://docs.xlwings.org/en/stable/

Web links and Video Lectures (e-Resources):

- https://freepdf-books.com/excel/
- https://jobscaptain.com/ms-excel-book-pdf/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Assignments to understand the operations in Excel and VB may be given to students

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IIISemester

Personality Development and Soft skills (AEC)			
Course Code	21CV383	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	2

Course objectives: Enable the students to

1. Experience self-fulfilment and overall development of one's own personality by developing personal skills.
2. Develop awareness about the significance of soft skills and impactful personality in professional life.
3. Improve the soft skills like effective communication, business correspondence, impressive presentation, leadership qualities, team-work, Time management leading to successful performance in interviews and group discussions.
4. Identify opportunities in career building and enhancement with proper time management and stress management.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Power point Presentation, video
3. Group discussion
4. Enacting, Demonstration
5. Industry interaction

Module-1

Introduction to Soft-Skills-Personal Skills: Knowing Oneself/Self-Discovery-Confidence Building-Defining Strengths- Developing Positive Attitude- Thinking Creatively-Improving Perceptions - Forming Values.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation

Module-2

Interpersonal and Social Skills: Understanding others-Developing Inter-personal relationship Team Building-Group dynamics-Networking-Problem-solving.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation.

Module-3

Communication Skills: Art of Listening-Art of Speaking-Art of Reading-Art of Writing-Art of Writing E-mails: Email etiquette

Teaching-Learning Process	Chalk and talk, Enacting, Demonstration.

Module-4

Presentation skills: Group discussion- mock Group Discussion using video recording - public speaking.

Teaching-Learning Process	Chalk and talk, Enacting, Demonstration, Activity

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Module-5	
Corporate Skills: Working with others- Developing a proper body language-behavioural etiquettes and mannerism- Time Management –Stress Management	
Teaching-Learning Process	Chalk and talk, PowerPoint Presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Develop effective communication skills (spoken and written) and effective presentation skills. Actively participate in group discussion / meetings / interviews and prepare & deliver presentations
2. Conduct effective business correspondence and prepare business reports which produce results.
3. Develop an understanding of and practice personal and professional responsibility.
4. Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

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Suggested Learning Resources:

Books

1. Meena K and V. Ayothi (2013) A Book on Development of Soft Skills (Soft Skills: A Road Map to Success), P. R. Publishers & Distributors, No. B-20 & 21, V. M. M Complex, Chatiram Bus Stand, Tiruchirappalli-620002. (Phone No: 0431-2702824Mobile No.: 9443370597, 9843074472)
2. Alex K. (2012) Soft Skills-Know Yourself & Know the World, S. Chand & Company LTD, Ram Nagar, New Delhi-110055. Mobile No.: 9442514814 (Dr.K.Alex

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Presentation on any social issues
- Quizzes

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Semester III

Infrastructure Finance			
Course Code	21CV384	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	1 hr

Course objectives:

- To understand the infrastructure components
- Opportunities in infrastructure development
- Financial sources and investment for infrastructure

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The online courses available should be shared with students
2. YouTube videos
3. Power point presentations
4. Visit to government, public and private organizations to understand infrastructure projects planning and execution procedures

Module-1

An Introduction to Infrastructure Finance

What is Infrastructure Business? Infrastructure then and now, Sector Structure and Size, Estimating the per capita cost.

Models of the Infrastructure Sectors

Classification system, Infrastructure and Service Organization, Business Models of Infrastructure Subsystems, Matrix of Owners and users of Infrastructure systems

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-2

Infrastructure and services:

How Infrastructure systems serve the built environment, , Services Structures and Equipment, Infrastructure support sector.

Investor and Business Opportunities in Infrastructure

Introduction, Bond Market, Stocks of Infrastructure Companies, infrastructure Funds, Infrastructure Indices, Commodity markets, Mortgage-Backed Securities, Private Equity and Infrastructure, The Infrastructure Support Sector, Infrastructure Investment Media, Corruption in Infrastructure Business, International Spending Plans.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-3

Infrastructure Performance

Tracking Infrastructure Performance, Systems to measure, Performance Standards, Infrastructure scorecard.

Financial Models for Infrastructure Organisations

General Management Model, General Financing Model, Sector Financing Models, Public Private Partnerships, Regulations.

Teaching-Learning	Chalk and talk, PowerPoint Presentation, YouTube videos

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Process	
Module-4	

Capital Markets for Infrastructure

Capital Requirement of Sectors, Capital flows of Infrastructure, Capital structure of Infrstructure sectors, Sources of Capital, Investment Banking.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-5

Revenues for the Infrastructure Sectors

Flow of Revenues, Rate Regulation, Revenue and cost of service analysis, Infrastructure revenue by Sector.

Opportunities and Risks for Infrastructure

Infrastructure as a policy sector, Infrastructure Policy elements, Sector Issues, Transformational Issues.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Prepare a comprehensive development plan for infrastructure projects
2. Plan funding required and procedure to be adopted for infrastructure development
3. Estimate revenue generation and implement investment plans
4. Understand risk involved and policy issues related to infrastructure projects

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion

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will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Infrastructure Finance, Dr. K B Singh, Dr. Ajay Pratap Yadav, ISBN: 9788195248070, First edition, 2021, Raj Publications
2. Project and Infrastructure Finance: Corporate Banking Perspective, Vikas Srivastava , V. Rajaraman, Oxford University press, ISBN-13 978-0199465002, 2017

Web links and Video Lectures (e-Resources):

- https://www.pdfdrive.com/project-finance-e40552174.html
- https://www.yumpu.com/en/document/view/63829168/e-book-download-principles-of-project-finance-full-free-collection

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Assignments on new planning and design of an infrastructure facility may be given

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Semester III

Fire Safety in Buildings			
Course Code	21CV385	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	1 hr

Course objectives:

- To understand the importance fire safety
- To learn various techniques involved in fire safety
- To design fire resistant buildings using proper materials and methods

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The online courses available should be shared with students
2. YouTube videos
3. Power point presentations
4. Visit to fire stations and understand various fire accidents

Module-1

Fire: Introduction, Basic concepts of fire protection, Fire as a process of combustion, planning for fire protection, fire resistance

Ventilation and fuel controlled fire, process of combustion: flashover condition, effect of fire on construction material, design of fire resistance steel structure, concrete structure

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-2

Fire safety: urban planning, escape and refuge, internal planning, detection and suppression

Introduction to lift design, design of lift system, expected stop and floor of reversal, different cases, simulation, arrangements and escalators

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-3

Introduction to flow system: water supply, constant demand, variable demand and diversity factor, control systems

Flow in pipe networks and fixture units, design of water supply distribution system, flow in waste water pipes

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-4

Introduction to HVAC: governing equations to HVAC process, numerical problem on HVAC system, psychometric chart, equation based approach

Electrical systems: design of electrical systems, intelligent building, life cycle cost and basics of building maintenance, stages of maintenance management, planning for building maintenance, periodicity of maintenance management, estimation of repair cycle, cost profile of maintenance, lamp replacement, building inspection, planned and Ad-hoc maintenance

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

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Module-5

Condition survey and health evaluation of buildings, diagnosis of building by visual survey, case studies of visual survey, effect of corrosion and alkali aggregate reaction, sampling and choice of test location

Non-destructive testing, core strength test, carbonation and chloride measurement, electrical method of progress measurement

Repair, rehabilitation, retrofit, periodicity and economics of condition survey, interpretation of test results

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand types of fire, combustion process and fire resistance
2. Plan for fire safety and design of lifts
3. Design flow network in buildings
4. Design of electrical systems and maintenance
5. Perform health evaluation of buildings and suggest remedies

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be scaled down to 50 marks

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

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Suggested Learning Resources:

Books

1. J A Purkiss, Fire Safety Engineering: Design of Structures, ISBN 13 978-8131220085, Elsevier, 2009
2. V K Jain, Fire Safety in Buildings, ISBN-13 978-938980219, New Age International Private Limited; Third edition, 2020
3. Fire protection, services and maintenance management of building, NPTEL video lecture, IIT, Delhi
4. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989.
5. Markus,T.A. & Morris, E.N., "BUILDING CLIMATE AND ENERGY" Pitman publishing limited. 1980.
6. Croome,J.D.&Roberts,B.M.,"AIRCONDITIONING AND VENTILATION OF BUILDINGS VOL-1".Pergamon press.
7. Building Services Design - T.W.MEVER
8. Building Engineering & System Design - F.S.MERRIT & J. AMBROSE
9. SP-35 (1987): Handbook of Water supply & drainage-BIS
10. N.B.C.-2007 BIS
11. Concept of building fire safety - D.EGAN.
12. Design of fire resisting structures - H.L. MALHOTRA.

List of reference materials/books/

1. An introduction to fire dynamics -D.DRYSDALE
2. Structural fire protection Edt by T.T.LIE
3. Elevator technology - G.C.BARNEY
4. HEATING VENTILATING AND AIR CONDITIONING Analysis and Design - Faye C. McQuiston and Jerald D. Parker.
5. Building Maintenance Management-R.LEE
6. Developments In Building Maintenance -I.EJ. GIBSON
7. ConcreteStructures:materials,Maintenance And Repair D.CAMPBELL,ALLEN & H.ROPER

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/105/102/105102176/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Assignment students: A case study of fire hazard in building and restoration procedure adopted

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SAMPLE TEMPLATE

III/IV Semester

Constitution of India and Professional Ethics (CIP)

Course Code	21CIP37/47	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15 Hours	Total Marks	100
Credits	01	Exam Hours	01 Hour

Course objectives: This course will enable the students

- To know the fundamental political structure & codes, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens.
- To understand engineering ethics and their responsibilities, identify their individual roles and ethical responsibilities towards society.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

✓ Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools and software's to meet the present requirements of the Global employment market.
   (i) Direct instructional method (Low /Old Technology),
   (ii) Flipped classrooms (High/advanced Technological tools),
   (iii) Blended learning (combination of both),
   (iv) Enquiry and evaluation based learning,
   (v) Personalized learning,
   (vi) Problems based learning through discussion,
   (vii) Following the method of expeditionary learning Tools and techniques,

1. Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can enhance the students in theoretical applied and practical skills in teaching of 21CIP39/49 in general.

Module - 1

Introduction to Indian Constitution: Definition of Constitution, Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly. Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Module - 2

Fundamental Rights (FR's), Directive Principles of State Policy (DPSP's) and Fundamental Duties (FD's) : Fundamental Rights and its Restriction and limitations in different Complex Situations. DPSP's and its present relevance in Indian society. Fundamental Duties and its Scope and significance in Nation building.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Module - 3

Union Executive : Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

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Module - 4

State Executive & Elections, Amendments and Emergency Provisions: State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (Why and How) and Important Constitutional Amendments till today. Emergency Provisions.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Module-5

Professional Ethics: Definition of Ethics & Values. Professional & Engineering Ethics. Positive and Negative aspects of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Professional Risks, Professional Safety and liability in Engineering. Trust & Reliability in Engineering, Intellectual Property Rights (IPR's).

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Course outcome (Course Skill Set)

At the end of the course the student should :

CO 1: Have constitutional knowledge and legal literacy.

CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks that is 20 marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

- The question paper will have 50 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks. Duration of the examination is 01 Hour.

Textbook:

1. **"Constitution of India & Professional Ethics"** Published by Prasaranga or published on VTU website with the consent of the university authorities VTU Belagavi.

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B.E MATHS SYLLABUS (for CH, CV, EEE, EIE, NANO)

Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

(Effective from the academic year 2022-2023)

SEMESTER - IV

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

Course Code	21MAT41	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:2:0	SEE Marks	50
Total Number of Contact Hours	40	Total Marks	100
Credits	03	Exam Hours	3

Course Objectives: This course(21MAT41) will enable students to:

1. Provide insight into applications of complex variables, conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.
2. Special functionsfamiliarize the Power series solution required to analyse the Engineering Problems.
3. To have insight into Statistical methods, Correlation and regression analysis.
4. To develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering.

Teaching-Learning Process (General Instructions):

ThesearesampleStrategies,whichteacherscanusetoacceleratetheattainmentofthevariouscourse outcomes.

1. Inadditiontothetraditionallecturemethod,differenttypesofinnovativeteachingmethodsmay be adopted so that the delivered lessons shall develop students' theoretical and applied mathematicalskills.
2. StatetheneedforMathematicswithEngineeringStudiesandProvidereal-lifeexamples.
3. Supportandguidethestudentsforself–study.
4. Youwillalsoberesponsibleforassigninghomework,gradingassignmentsandquizzes,and documenting students'progress.
5. Encouragethestudentsforgrouplearningtoimprovetheircreativeandanalyticalskills.
6. Showshortrelatedvideolecturesinthefollowingways:
   - Asanintroductiontonewtopics(pre-lectureactivity).
   - As a revision of topics (post-lectureactivity).
   - As additional examples (post-lectureactivity).
   - Asanadditionalmaterialofchallengingtopics(pre-andpost-lectureactivity).

   Asamodelsolutionforsomeexercises(post-lectureactivity).

Module – 1

Complex Analysis: Review of a function of a complex variable, limits, continuity and differentiability. Analytic functions: Cauchy-Riemann equations in cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thomson method, Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's integral formula and problems. **(8 Hours)**

Self-Study: Conformal transformations: Discussion of transformations: $w = z^2$, $w = e^z$, $w = z + 1/z$ $(z \neq 0)$. Bilinear transformations- Problems.

(RBT Levels: L1, L2 and L3)

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Pedagogy	Chalk and Board, Problem based learning

Module – 2

Special functions: Series solution of Bessel's differential equation leading to $J_n(x)$ Bessel's function of the first kind, Properties, Orthogonality of Bessel's functions. Series solution of Legendre's differential equation leading to $P_n(x)$-Legendre polynomials. Rodrigue's formula (without proof), problems. **(8 Hours)**

Self Study: Recurrence Relations.

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem based learning

Module – 3

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.

Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b, y = ax^b and y = ax^2 + bx + c$. **(8 Hours)**

Self-study: Angle between two regression lines, problems.

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem based learning

Module – 4

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous),probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. **(8 Hours)**

Self-study: Exponential distribution.

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem based learning

Module – 5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test ofhypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **(8 Hours)**

Self-Study: Point estimation and interval estimation.

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem based learning

Course Outcomes

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Course Outcomes: At the end of the courses, the students will be able to:

1. Use the concepts of an analytic function and complex potentials to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
2. Obtain Series Solutions of Ordinary Differential Equation.
3. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
4. Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

ASSESSMENT PATTERN (BOTH CIE AND SIE)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

First test at the end of 5th week of the semester

Second test at the end of the 10th week of the semester

Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

First assignment at the end of 4th week of the semester

Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

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Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal Khanna Publishers 44th Edition, 2017.
2. Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed.(Reprint), 2016.

References:

1. Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995.
2. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010.
3. A Text-Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014.
4. Advanced Engineering Mathematics Chandrika Prasad and Reena Garg Khanna Publishing, 2018.

Web links and Video Lectures (e-Resources):

http://nptel.ac.in/courses.php?disciplineID=111

http://www.class-central.com/subject/math(MOOCs)

http://academicearth.org/

http://www.bookstreet.in.

VTU EDUSAT PROGRAMME – 20

VTU e-ShikshanaProgram

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

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Subject- Fluid Mechanics and Hydraulics 21CV42

Teaching hours /Week- 2+2+2

Experiments suggested for lab(IPCC)

1) Verification of Bernoulli's equation
2) Determination of Cd for Venturimeter or Orificemeter
3) Determination of Hydraulic coefficients of small vertical orifice
4) Calibration of Triangular notch
5) Determination of Major losses in pipes
6) Determination of cd for ogee or broad crested weir
7) Determination of force exerted by a jet on flat and curved vanes
8) Determination of efficiency of centrifugal pump
9) Determination of efficiency of Kaplan or Francis turbine
10) Determination of efficiency of Pelton wheel turbine

Course outcomes

Students will develop understanding of

1.The use of various instruments for fluid flow measurement

2.Working of Hydraulic machines under various conditions of working

Reference books

1.Sarbijit Singh,Experiments in Fluid Mechanics-PHI pvt. Ltd.New Delhi

2.Hydraulics and Fliud Machines –dr.P.N.Modi &Dr.S.M..Seth, Standard book House,New Delhi

Note- Lab hours 2 per week and experiments can be reduced to 8

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IV Semester

Fluid Mechanics and Hydraulics			
Course Code	21CV42	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	3

Course objectives: Make the students to learn

1Fundamentals of fluid pressure and Hydrostatic laws
2 Principles of Kinematics, Hydrodynamics and basic design of pipes
3 Flow measurements
4Design of open channels and energy concepts
5.Working principles of the hydraulic machines

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Power point Presentation, video
2. Video tube, NPTEL materials
3. Quiz/Assignments/Open book test to develop skills
4. Adopt problem based learning (PBL)to develop analytical and thinking skills
5. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

Module-1	
Fluids and their properties, Fluid pressure measurements, Pascal's law, Measurement of pressure using manometer, Total pressure and centre of pressure on vertical and inclined plane surfaces	10 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation

Module-2	
Kinematics- Types of fluid flow, continuity equation in Cartesian coordinates, flow nets, Dynamics- Euler's equation of motion, Bernoulli's equation, Application-Venturimeter, Orificemeter, Pitot tube	10 hours
Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, Analysis in Laboratory

Module-3	
Classification of orifice and mouth piece, Hydraulic coefficients, Discharge over Rectangular, Triangular and Cipoletti notch Flow through pipes-Major and minor losses, pipes in series and parallel, concepts of water hammer and surge tanks	10 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs

Module-4	
Open Channel Hydraulics- Classification of Flow through channels, Most economical channel sections: Rectangular, Triangular, Circular, Uniform flow, Specific energy Non-Uniform flow- Hydraulic jump, GVF equation	10 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs

Module-5	
Impact of jet on curved vanes ,momentum equation, Impact of jet on stationary and moving curved vanes	10 hours

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Turbines- Pelton wheel and components, Velocity triangle Reaction turbine-Francis turbine ,Working proportions Centrifugal Pumps-Work done and efficiency, Multi stage pumps	
Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs and visit to power station as part of industrial visit

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand fundamental properties of fluids and solve problems on Hydrostatics
2. Apply Principles of Mathematics to represent Kinematics and Bernoulli's principles
3. Compute discharge through pipes, notches and weirs
4. Design of open channels of various cross sections
5. Design of turbines for the given data and understand their operation characteristics

PRACTICAL COMPONENT OF IPCC

Sl. NO	Experiments
1	Verification of Bernoulli's equation
2	Determination of Cd for Venturimeter or Orificemeter
3	Determination of Hydraulic coefficients of small vertical orifice
4	Calibration of Triangular notch
5	Determination of Major losses in pipes
6	Determination of Cd for ogee or broad crested weir
7	Determination of force exerted by a jet on flat and curved vanes
8	Determination of efficiency of centrifugal pump
9	Detérmination of efficiency of Kaplan or Francis turbine
10	Determination of efficiency of Pelton wheel turbine

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. P.N.Modi and S.M.Seth-Hydraulics and Fluid Mechanics, including Hydraulic machines, standard Book House, New Delhi
2. K Subramanya- Fluid Mechanics and Hydraulic Machines, Tata McGrawhill, New Delhi
3. R.K. Bansal- A text book of Fluid Mechanics and Hydraulic Machines- Laxmi Publications ,New Delhi

Reference books

1. Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford- Fluid Mechanics ,Tata McGraw Hill publishing Co Ltd,New Delhi
2. J.F.Douglas,J .M .Gasoreik, John Warfield ,Lynne Jack – Fluid Mechanics ,Pearson ,Fifth edition.
3. K.Subramanya- Fluid Mechanics and Hydraulic Machines, Problems and Solutions, Tata McGrawhill, New Delhi
4. S.K SOM and G.Biswas – " introduction to Fluid Mechanics and Fluid Machines, Tata Mcg raw Hill, New Delhi

Web links and Video Lectures (e-Resources):

- https://searchworks.stanford.edu/view/10496310
- https://searchworks.stanford.edu/view/13576277
- https://searchworks.stanford.edu/view/11842972

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars /Quiz (to assist in GATE preparations)
- Demonstrations in lab
- Self-Study on simple topics
- Simple problems solving by C+
- Virtual lab experiments

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IV Semester

PUBLIC HEALTH ENGINEERING			
Course Code	21CV43	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+2+0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	3

Course objectives:

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Study drinking water quality standards and to illustrate qualitative analysis of water.
3. Analysis of physical and chemical characteristics of water and wastewater.
4. Understand and design of different unit operations and unit process involved in water and wastewater treatment process

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1

Introduction: Water: Need for protected water supply, Demand of Water: Types of water demands - domestic demand, industrial, institutional and commercial demand, public use and fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor.

Design period and factors governing design period. Methods of population forecasting and numerical problems. Physico chemical characteristics of water(Analysis to be conducted in laboratory session). Sampling.

8hours

Teaching-Learning Process	Chalk and talk, powerpoint presentation, demonstration and analysis in laboratory

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Module-2	
Water Treatment: Objectives, Unit flow diagrams – significance of each unit, Aeration process- Limitations and types, **Sedimentation -** Theory, settling tanks, types and design with numericals, Coagulation and flocculation, types of coagulants.(Optimisation of coagulant to be carried out in the laboratory).**Filtration:** mechanism, theory of filtration, types offilters: slow sand, rapid sand and pressure filters. Operation and cleaning. Design of slow and rapid sand filter without under drainage system (numericals) **8hours**	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation,anim.ations and visit to in around water treatment plant

Module-3	
Disinfection: Methods of disinfection with merits and demerits. Breakpoint of chlorination (Analysis to be conducted in laboratory session) Softening: Lime soda and Zeolite process. **Wastewater**: **Introduction:** Need for sanitation, methods of sewage disposal, types of sewerage systems, **Treatment of municipal waste water:** Waste water characteristics(Analysis to be conducted in laboratory session): sampling, significance and techniques, physical, chemical and biological characteristics,Numericals on BOD, **8hours**	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations

Module-4	
Treatment Process: flow diagram for municipal waste water Treatment unit operations and process,Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks (no numericals), Suspended growth system - conventional activated sludge process and its modifications. **8hours**	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation,, animations, and visit to in around waste water treatment plant

Module-5	
Attached growth system – trickling filter, numericals on Trickling filters, bio-towers and rotating biological contactors. Principle of stabilization ponds, oxidation ditch, Sludge digesters(aerobic and anaerobic), Equalization., thickeners and drying beds. 10hours	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations

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EXPERIMENTS

Experiments to be carried out are:

1. Determination of pH, Conductivity, TDS and Turbidity.
2. Determination of Acidity and Alkalinity
3. Determination of Calcium, Magnesium and Total Hardness.
4. Determination of Dissolved Oxygen
5. Determination of BOD.
6. Determination of Chlorides
7. Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.
8. Determination of Solids in Sewage: (i) Total Solids, (ii) Suspended Solids, (iii) Dissolved Solids, (iv)Volatile Solids, Fixed Solids (v) Settleable Solids.
9. Determination of optimum coagulant dosage using Jar test apparatus.
10. Determination Nitrates and Iron by spectrophotometer
11. Determination of COD(Demonstration)
12. 13. Air Quality Monitoring (Demonstration)

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Estimate average and peak water demand for a community.
- Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
- Design the different units of water treatment plant
- Understand and design the various units of wastewater treatment plant
- Acquire capability to conduct experiments and estimate the concentration of different parameters and compare the obtained results with the concerned guidelines and regulations..

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Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

- Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
- S. K. Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010
- B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.
- B C Punmia, "Environmental Engineering vol-II", Laxmi Publications 2nd, 2016
- Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
- S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017
- CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.
- Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York,2008.

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Web links and Video Lectures (e-Resources):

Lecture 01: Background and Course Introduction
https://youtu.be/yDnrv-oGSBc
Lecture 02: Water Sources and Availability
https://youtu.be/K4Vtv0cmybI
Lecture 03: Water Uses
https://youtu.be/9H7dPkWOsjA
Lecture 04: Water Supply Key Issues and Concerns
https://youtu.be/JueYGPbsflw
Lecture 05: Urban water services and water supply systems
https://youtu.be/bCKm9KkcQtw
Lecture 06: Urban water services and water supply systems
https://youtu.be/s0hv0ZlM1bA
Lecture 07: Components of Water Demand
https://youtu.be/mVmErXpIp64
Lecture 08: Fluctuations in Water Demand
https://youtu.be/qXUwy5OnX9Q
Lecture 09: "Concept of Design Period and Design Population Need to Forecast Population Population Forecasting Methods
https://youtu.be/QyLdA_qhUog
Lecture 10: Demand Forecasting and Design Capacities
https://youtu.be/rKTwjyx7E8A
Lecture 11: Water Sources and Collection of Water
https://youtu.be/TvEGgZw1El4
Lecture 12: Surface Water Intakes
https://youtu.be/GcQOyAdG5OM
Lecture 13: Surface Water Intakes Systems
https://youtu.be/r1oJtm_SXz4
Lecture 14: Groundwater Intake
https://youtu.be/Zo1p7uRDEmM
Lecture 15: Well Interferences,Well losses and Efficiency
https://youtu.be/dRU5M_WICU0
Lecture 16: Raw water Conveyance and Pumping
https://youtu.be/iQwEoEhujTc
Lecture 17: Practice Problems
https://youtu.be/e5bduQiz5NY
Lecture 18 : Raw Water Storage
https://youtu.be/WZlI7kWoUjE
Lecture 19 : Treated Water Storage
https://youtu.be/BuZ48afjd04
Lecture 20 : Placement, Design and Construction of Storage Reservoirs
https://youtu.be/nQCZbXaBb1o
Lecture 21 : Practice Problems on Reservoir Capacity Estimation
https://youtu.be/yuPLzQvmU-c
Lecture 22 : Water Quality and Water Pollutants
https://youtu.be/fZPrv6BENPI
Lecture 23 : Water Quality Parameters
https://youtu.be/6VuHxD3t9kw
Lecture 24 : Philosophy of Water Treatment
https://youtu.be/6I-eBqE7Hew
Lecture 25 : Water Treatment Units Screening and Aeration

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Lecture 26 : Water Treatment Units Sedimentation
https://youtu.be/T1M4Ecjwq7Q
Lecture 27 : Practice Problems On Sedimentation
https://youtu.be/Zlh2mpOjIMU
Lecture 28: Coagulation and Flocculation: Theory
https://youtu.be/aAo2bBaF0yU
Lecture 29: Coagulation and Flocculation: Selection and Application
https://youtu.be/44p0lN31ogo
Lecture 30: Coagulation and Flocculation: Design Operation and Process Control
https://youtu.be/v0TDfCz_jLU
Lecture 31: Filtration Theory and Slow Sand Filters
https://youtu.be/nuJQe9F_2zI
Lecture 32: Rapid Sand Filter: Filter Media and Components
https://youtu.be/3qw3sKcuQlY

Lecture 33: Rapid Sand Filters and Pressure Filters
https://youtu.be/PEX_0DebrSQ
Lecture 34: Practice Problems Coagulation Flocculation and Filtration
https://youtu.be/73jxsBCDuq4
Lecture 35: Disinfection Basic
https://youtu.be/d4UG9Xivuik
Lecture 36: Chlorination
https://youtu.be/L3eSkeOU3jY

- Activity Based Learning (Suggested Activities in Class)/ Practical Based learning http://nptel.ac.in
- https://swayam.gov.in
- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

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IV Semester

ANALYSIS OF STRUCTURES			
Course Code	**21CV44**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: This course will enable students

1. To determine slope and deflections in beams and trusses.
2. To analyse arches and cable structures.
3. To analyse different structural systems and interpret data using slope deflection method.
4. To apply matrix operations in analysing structures.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Video tube, NPTEL materials
2. Quiz/Assignments/Open book test to develop skills
3. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

Module-1

Deflection of Beams: *Moment area method* – Derivation, Mohr's theorems, Sign convention; Application of moment area method to determinate prismatic beams, beams of varying cross section; Use of moment diagram by parts; *Conjugate beam method* – Real beam and conjugate beam, conjugate beam theorems; Application of conjugate beam method to determinate beams of varying cross sections.

Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.

Module-2

Energy Principles and Energy Theorems: *Principle of virtual displacements*; *Principle of virtual forces*, Strain energy and complementary energy; Strain energy due to axial force, bending shear and torsion; Deflection of determinate beams and trusses using total strain energy; Deflection at the point of application of single point load; *Castigliano's theorems*, application of Castigliano's theorems to calculate deflection of trusses, frames; Special application – Dummy unit load method.

Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.

Module-3

Arches and Cables: Three-hinged circular and parabolic arches with supports at the same and different levels; Determination of normal thrust, radial shear and bending moment; Analysisof cables under point loads and UDL; Length of cables with supports at the same and different levels; Stiffening trusses for suspension cables.

Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.

Module-4

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3

Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.

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Module-5

Matrix Methods of Structural Analysis: Definition of stiffness and flexibility methods, comparison to classical methods.

Stiffness Method: Stiffness matrix. Analysis of continuous beams and plane trusses using system approach; Analysis of simple orthogonal plane frames using system approach with kinematic indeterminacy up to 3.

Teaching-Learning Process	Chalk and talk. Demonstration using relevant structural analysis software.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Evaluate slope and deflections in beams using geometrical methods.
2. Determine deflections in trusses and frames using energy principles.
3. Analyse arches and cables for stress resultants.
4. Apply slope defection method in analysing indeterminate structures and construct bending moment diagram.
5. Analyse continuous beams, frames and trusses using stiffness matrix method of analysis.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Reddy, C.S., *Basic Structural Analysis*, 3rd ed., Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2011.
2. Hibbeler, R.C., Structural Analysis, 9th edition., Pearson publications., New Delhi, 2012.
3. Thandavamoorthy, T.S., Structural Analysis, 6th edition., Oxford University press., New Delhi,2015.

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Reference Books

1. Charles Head Norris, John Benson Wilbur and Senol Utku., Elementary Structural Analysis, 4th edition., Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2003.
2. Hall, A. and Kabaila, A.P., *Basic Concepts of Structural Analysis*, Pitman Publishing, London, John Wiley & Sons, New York, 1977.
3. Wang, C.K., Intermediate Structural Analysis, McGraw-Hill International Book Co., 1985.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/105105166
- https://nptel.ac.in/courses/105105166
- https://nptel.ac.in/courses/105105166
- https://nptel.ac.in/courses/105105109
- https://nptel.ac.in/courses/105105109
- https://nptel.ac.in/courses/105105109

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars /Quiz (to assist in GATE preparations)
- Demonstrations in using softwares
- Self-Study on simple topics
- Simple problems solving by Etabs/Staad pro.

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Earth Resources and Engineering Laboratory			
Course Code	21CVL46	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0: 0:2:0	SEE Marks	50
Credits	01	Exam Hours	03

Course objectives:

- To provide decision support on the nature of the basic raw materials used in construction.
- To provide decision support on Lithological characters and subsurface conditions.
- To describe various geological maps and interpretation of geological data for mining and subsurface investigations.
- To understand the subsurface using geospatial data.

Sl.NO	Experiments
1	Evaluation of minerals based on physical properties for basic raw material for construction, industrial application (2 classes)
2	Investigation of rock based on physical, textural, and mineralogical properties for construction (2 classes)
3	Tests on aggregates(crushing, impact analysis, shape- elongation water absorption, flakiness as per IS Code 2386), Decorative purpose, foundation, monumental works. (1 class)
4	Tests on bricks (load tests and water absorption tests);Size analysis of sands(sieving and presentation and calculation in Microsoft Excel) (1 class)
5	**Geologic maps studies(6 classes)** Cross-section studies of Geological maps for suitability evaluation and subsurface investigation of geological conditions for Dams, tunnels water harvesting, aqua duct, bridges under conditions of Horizontal strata, inclined strata, Folded and Faulted beds, Unconformity, Intrusion relevant–; construction/ generation of Geological maps based on borehole data
6	**Geospatial data analysis (3 classes)** • Interpretation of toposheets– • Visual interpretation of FCCs (Geomorphology and Landuse/landcover mapping) and TCCs , • Software application(QGIS)
	• Demonstration Experiments (For CIE)
7	**Geophysical exploration – (2 classes)** • Electrical resistivity methods for subsurface investigation – and its Interpretation, lateral and vertical sounding

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Comprehend the relations between minerals and rocks based on their physicalproperties
- Assessthe suitability of materials used in building construction
- Differentiate geological investigations necessary for the construction of dams, bridges,and tunnels
- Describe the groundwater investigation using resistivity methods
- Understand the applications of Geospatial technology in Civil Engineering.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly

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by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of the Regulation book

Suggested Learning Resources:

- https://mg-nitk.vlabs.ac.in/mining-geology/List%20of%20experiments.html
- https://www.youtube.com/watch?v=D_uYjqZ1nYw
- https://www.youtube.com/watch?v=NHolzMgaqwE

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SAMPLE TEMPLATE

III/IV Semester

Constitution of India and Professional Ethics (CIP)

Course Code	21CIP37/47	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15 Hours	Total Marks	100
Credits	01	Exam Hours	01 Hour

Course objectives: This course will enable the students

- To know the fundamental political structure & codes, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens.
- To understand engineering ethics and their responsibilities, identify their individual roles and ethical responsibilities towards society.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

✓ Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools and software's to meet the present requirements of the Global employment market.

(i) Direct instructional method (Low /Old Technology),
(ii) Flipped classrooms (High/advanced Technological tools),
(iii) Blended learning (combination of both),
(iv) Enquiry and evaluation based learning,
(v) Personalized learning,
(vi) Problems based learning through discussion,
(vii) Following the method of expeditionary learning Tools and techniques,

1. Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can enhance the students in theoretical applied and practical skills in teaching of 21CIP39/49 in general.

Module - 1

Introduction to Indian Constitution: Definition of Constitution, Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly. Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Module - 2

Fundamental Rights (FR's), Directive Principles of State Policy (DPSP's) and Fundamental Duties (FD's) : Fundamental Rights and its Restriction and limitations in different Complex Situations. DPSP's and its present relevance in Indian society. Fundamental Duties and its Scope and significance in Nation building.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Module - 3

Union Executive : Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

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Module - 4

State Executive & Elections, Amendments and Emergency Provisions: State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (Why and How) and Important Constitutional Amendments till today. Emergency Provisions.

Teaching-Learning Process	Chalk and talk method. Videos. Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Module-5

Professional Ethics: Definition of Ethics & Values. Professional & Engineering Ethics. Positive and Negative aspects of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Professional Risks, Professional Safety and liability in Engineering. Trust & Reliability in Engineering, Intellectual Property Rights (IPR's).

Teaching-Learning Process	Chalk and talk method. Videos. Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Course outcome (Course Skill Set)

At the end of the course the student should :

CO 1: Have constitutional knowledge and legal literacy.

CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks that is 20 marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

- The question paper will have 50 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks. Duration of the examination is 01 Hour.

Textbook:

1. **"Constitution of India & Professional Ethics"** Published by Prasaranga or published on VTU website with the consent of the university authorities VTU Belagavi.

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SAMPLE TEMPLATE

BE - III/IV Semester – Common to all

[illegible]			
[illegible] (Course Code)	21KSK39/49	[illegible]	50
[illegible] (Teaching Hours / Week (L:T:P: S)	0:2:0:1	[illegible]	50
[illegible] Total Hours of Pedagogy	25 [illegible]	[illegible]	100
[illegible] (Credits)	01	[illegible]	01 [illegible]

[illegible]:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

[illegible] **(Teaching-Learning Process - General Instructions) :**

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

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2. [illegible]
3. [illegible]

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1. [illegible] - [illegible]
2. [illegible] : [illegible] - [illegible]
3. [illegible] - [illegible]

[illegible]	[illegible]

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SAMPLE TEMPLATE

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□□□□□□□□□ **(course Outcomes):**

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□□□□□□□□□□ □□□□□ **(Assessment Details- both CIE and SEE) :**

(methods of CIE - MCQ, Quizzes, Open book test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and 35% marks in SEE to pass. Theory Semester End Exam (SEE) is conducted for 50 marks (01 hour duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour)**

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester

2. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

3. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

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SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

1. The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

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SAMPLE TEMPLATE

BE - III / IV Semester – Common to All

[illegible] - **baLake Kannada (Kannada for Usage)** [illegible] - (Prescribed Textbook to Learn Kannada)			
[illegible] (Course Code)	21KBK39/49	[illegible] (Continuous Internal Evaluation Marks)	50
[illegible] (Teaching Hours / Week (L:T:P: S)	0:2:0:1	[illegible] (Semester End Examination Marks)	50
[illegible] Total Hours of Pedagogy	25 [illegible]	[illegible] (Total Marks)	100
[illegible] (Credits)	01	[illegible] (Exam Hours)	01 [illegible]

[illegible] **(Course Learning Objectives):**

- To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.

[illegible] **(Teaching-Learning Process - General Instructions) :**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. [illegible].
2. [illegible].
3. [illegible].
1. [illegible].
2. [illegible].

Module-1

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities
3. Key to Transcription.
4. [illegible] - **Personal Pronouns, Possessive Forms, Interrogative words**

[illegible]	[illegible].

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Module-2

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2. □□□, □□□□□□ □□□□□ □□□□□□□□□□□□□□□, □□□□□□ □ Qualitative, Quantitative and Colour Adjectives, Numerals
3. PÁgÀPÀ gÀÆ¥ÀUÀ¼ÀÄ "ÀÄvÀÄÛ «¨sÀQÛ ¥ÀævÀåAiÀÄUÀ¼ÀÄ – ¸À¥ÀÛ«Ä «¨sÀQÛ ¥ÀævÀåAiÀÄ – (D, CzÀÄ, CªÀÅ, Cºè) Predictive Forms, Locative Case

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Module-3

1. ZÀvÀÄyð «¨sÀQÛ ¥ÀævÀåAiÀÄzÀ §¼ÀPÉ "ÀÄvÀÄÛ ¸ÀASÁåªÁZÀPÀUÀ¼ÀÄ - Dative Cases, and Numerals
4. ¸ÀASÁåUÀÄtªÁZÀPÀUÀ¼ÀÄ "ÀÄvÀÄÛ §ºÀÄªÀZÀ£À £ÁªÀÄgÀÆ¥ÀUÀ¼ÀÄ - Ordinal numerals and Plural markers
5. £ÀÆå£À / ¤µÉÃzsÁxÀðPÀ QæAiÀiÁ¥ÀzÀUÀ¼ÀÄ "ÀÄvÀÄÛ "Àtð UÀÄtªÁZÀPÀUÀ¼ÀÄ

Defective / Negative Verbs and Colour Adjectives

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Module-4

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   Permission, Commands, encouraging and Urging words (Imperative words and sentences)
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   Accusative Cases and Potential Forms used in General Communication
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6. □□□□□□ (ತರತಮ, □□□□□ □□□□ □□□□□ □□□□□ □□□□ □□□□□□□□□□ □□□□□ □□□□□□□□□□ ಪದಗಳ□□□- Comparitive, Relationship, Identification and Negation Words

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Module-5

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2. □□, -□□, - □□, - □□□, - □□□, - □□□□, - □□, -□□, □□□, □□□□□□ □□□□□□□□□□□□□□ □□□, □□□□□□□□ □□□□□ □□□□□□□ □□□ □□□□□ □□□□ - Formation of Past, Future and Present Tense Sentences with Verb Forms
3. **Kannada Vocabulary List :** □□□□□□□□□□□□ □□□□□□□□□ □□□□□ □□□□□ - **Kannada Words in Conversation**

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[illegible]

[illegible]: **course Outcomes (Course Skill** Set): At the end of the Course, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with kannada speakers.
5. To speak in polite conservation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour)**

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester

7. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

8. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

[illegible] - **Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

2. The question paper will have 50 questions. Each question is set for 01 mark.
3. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

Textbook :

[illegible]

[illegible] : [illegible]. [illegible]. [illegible]

[illegible], [illegible] [illegible] [illegible], [illegible].

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SAMPLE TEMPLATE

IV Semester

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT

Course Code	**21UHV49**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0+2+0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 20 lectures (discussions)
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation
   - the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Module-1

Introduction to Value Education (4 hours)

Right Understanding, Relationship and Physical Facility (Holistic Developmentand the Role of Education)

Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations

Teaching-Learning Process	Introduction to Value Education- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos

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Module-2

Harmony in the Human Being (4 hours)

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Teaching-Learning Process	Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos

Module-3

Harmony in the Family and Society (4hours)

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Teaching-Learning Process	Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos

Module-4

Harmony in the Nature/Existence (4 hours)

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the FourOrders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Teaching-Learning Process	Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos

Module-5

Implications of the Holistic Understanding – a Look at Professional Ethics (4 hours)

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and UniversalHuman Order, Competence in Professional EthicsHolistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Teaching-Learning Process	Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos

Course outcome (Course Skill Set)

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

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Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

1. Holistic vision of life
2. Socially responsible behaviour
3. Environmentally responsible work
4. Ethical human conduct
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

-READINGS:

Text Book and Teachers Manual

a. The Textbook

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2ndRevised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-

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b. The Teacher"s Manual

Teachers" Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W.Behrens III, 1972, Limits to Growth – Club of Rome's report, UniverseBooks.
16. ANagraj,1998,JeevanVidyaEkParichay,DivyaPathSansthan,Amarkantak.
17. PLDhar,RRGaur,1990,ScienceandHumanism,CommonwealthPublishers.
18. ANTripathy,2003,HumanValues,NewAgeInternationalPublishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik)KrishiTantraShodh,Amravati.
20. EGSeebauer&RobertL.Berry,2000,FundamentalsofEthicsforScientists&Engineers ,Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics(including HumanValues),EasternEconomy Edition,PrenticeHallofIndia Ltd.
22. BPBanerjee,2005,Foundationsof EthicsandManagement,ExcelBooks.
23. B LBajpai,2004,Indian Ethosand Modern Management,New RoyalBookCo., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

1. Value Education websites, https://www.uhv.org.in/uhv-ii, http://uhv.ac.in, http://www.uptu.ac.in
2. **Story of Stuff, http://www.storyofstuff.com**
3. **Al Gore, An Inconvenient Truth, Paramount Classics, USA**
4. **Charlie Chaplin, Modern Times, United Artists, USA**
5. **IIT Delhi, Modern Technology – the Untold Story**
6. Gandhi A., Right Here Right Now, Cyclewala Productions
7. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
8. https://fdp-si.aicte-india.org/8dayUHV_download.php
9. https://www.youtube.com/watch?v=8ovkLRYXIjE
10. https://www.youtube.com/watch?v=OgdNx0X923I
11. https://www.youtube.com/watch?v=nGRcbRpvGoU
12. https://www.youtube.com/watch?v=sDxGXOgYEKM

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

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V Semester

Hydrology and Water Resource Engineering			
Course Code	21CV51	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3+0+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: Make the students to learn

1. Concept of hydrology, components of hydrologic cycle, hydrologic processes such as precipitation, infiltration, evaporation and transpiration.
2. Estimation of runoff and use the concept of unit hydrograph.
3. Systems and methods of irrigation, crop water requirement.
4. Canals, canal alignment, design methods of canals. Computation of reservoir capacity.
5. Concepts of floods and droughts, importance of water conservation and water management.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Power point Presentation
2. Video tube, NPTEL materials
3. Quiz/Assignments/Open book test to develop skills
4. Adopt problem based learning (PBL)to develop analytical and thinking skills
5. Encourage collaborative learning, site visits related to subject and impart practical knowledge
6. Mini projects

Module-1	
Hydrology: Introduction, Global distribution of water and Indian water availability. Hydrologic cycle (Horton's) qualitative and engineering representation. **Precipitation:** Forms and types, measurement of rain fall using Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs. **Losses from Precipitation:** Evaporation process, factors affecting evaporation, measurement using IS class-A Pan, reservoir evaporation and control. Factors affecting Evapo-transpiration. Infiltration, Factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation& PBL

Module-2	
Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis. **Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation & PBL

Module-3	
Irrigation: System of irrigation: surface and ground water, flow irrigation, lift irrigation. Methods of irrigation: surface, sprinkler and drip/micro irrigation. **Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.	8 hours
Teaching-Learning Process	Chalk and talk, PowerPoint Presentation and Model preparation

Module-4

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Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Regime channels, Design of canals by Lacey's and Kennedy's method (No numerical examples). **Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and Field visits.
Module-5	
Flood Management: Indian rivers and floods, Causes of floods, Alleviation, Levees and floodwalls, Flood ways, Channel improvement, Flood damage analysis. **Drought Management:** Definition of drought, Causes of drought, measures for water conservation and augmentation, drought contingency planning. **Water harvesting:** rainwater collection, small dams, runoff enhancement, runoff collection, Restoration and rejuvenation of water bodies (ponds and lakes)	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and Mini-projects

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Provide a background in the theory of hydrological processes and their measurement
2. Estimate runoff and develop unit hydrographs.
3. Find the water requirement and frequency of irrigation for various crops.
4. Find the canal capacity and compute the reservoir capacity.
5. Analyse floods and droughts. Emphasise on the importance of conservation of water and water bodies.

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V Semester

TRANSPORTATION ENGINEERING			
Course Code	21CV52	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(32:02:02:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	0[illegible]	Exam Hours	03

Course objectives:

- Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
- Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
- Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
- Understand pavement and its components, pavement construction activities and its requirements.
- Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and alsointroduce the students to highway financing concepts

Teaching-Learning Process (General Instructions)

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation. Characteristics of road transport, Importance of Roads in India, Current Road development Programmes in India.
Highway Development and Planning: Highway Development in India, Highway Planning, Planning Surveys and Interpretation, Highway Planning in India.
Highway Alignment and Project preparation: Highway Alignment, Engineering Surveys for Highway Alignment, Drawings and Reports, Highway Projects, Preparation of Detailed Project Report

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Highway Geometric Design of horizontal alignment elements: Cross sectional elements, Sight distance, Design of Horizontal alignment, Design of vertical alignment.
Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

Pavement Materials: Sub ~~grade soil~~grade soil -desirable properties-HRB soil classification-determination of CBR and modulus of sub grade reaction with Problems, Aggregates- Desirable properties. Bituminous Binders & Mixes- Types, desirable properties. Pavement Quality concrete- Materials, Requirements.
Pavement Construction: General features, Embankment and Subgrade, Construction of Flexible pavements, Construction of CC pavements.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3. Compliment the understanding of Pavement materials with Lab demos. 4. Plan for site visits for students, where pavement construction is going on.

Module-4

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Highway Drainage: Significance and requirements, Surface drainage system and Design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual Cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-5

Elements of Traffic Engineering – Traffic characteristics, Traffic Engineering Studies and Analysis, Traffic Regulation and Control.

Elements of Railways and Airport Engineering - Railways: Introduction, classification of routes; railway gauge, coning of wheels and canting of rails, train resistance and hauling power; track components: rails, sleepers, fastenings, ballast and formation. **Airports**: Introduction, Layout of an airport with component parts and functions of each, Aircraft Characteristics – Airport Classifications, - Site selection- regional Planning. Orientation of runway by using wind rose diagram with examples

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3. Conduction of Basic traffic studies by students in the field.

PRACTICAL COMPONENT OF IPCC

Experiments

1. **Tests on Aggregates**
   a. Aggregate Crushing value
   b. Los Angeles abrasion test
   c. Aggregate impact test
   d. Aggregate shape tests (combined index and angularity number)
2. **Tests on Bituminous Materials**
   a. Penetration test
   b. Ductility test
   c. Softening point test
   d. Specific gravity test
3. **Tests on Soil**
   a. Wet sieve analysis
   b. CBR test
4. **Tests on Bituminous Mixes**
   a. Marshall Method (Demo Experiment)

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessaryfield investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavementconstruction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour)**

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks.**

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Text Books

1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K. Subramaniam, "Transportation Engineering", SciTech Publications, Chennai.
5. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
6. Chandra S. and Agarwal M.M. "Railway Engineering", Oxford University Press India.

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7. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nem Chand and Bros.
8. Khanna S.K. and Justo C.E.G. Highway Material Testing, Nem Chand & Bros

Reference Books:

1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.
3. C. Jotin Khisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/105101087

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Demonstrations in Lab
- Self-Study on simple topics
- Simple problems solving using Excel
- Discussion of case studies
- Virtual Lab experiments

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V Semester

DESIGN OF RC STRUCTURAL ELEMENTS			
Course Code	21CV53	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. Acquire knowledge in analysis and design of RC elements.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge.

Module-1

Introduction to working stress and limit State Design: Introduction to working stress method, Difference between Working stress and Limit State Method of design.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-2

Limit State Analysis of Beams:

Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-3

Limit State Design of Beams: Design of singly reinforced beams with check for shear, check for development length and other checks. Design of doubly reinforced beams and flanged sections without checks.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-4

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Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-5

Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
4. Owns professional and ethical responsibility.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

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1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. N Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

Reference Books:

1. P C Varghese, "Limit State design of reinforced concrete", PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publishers.
3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications.
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press.
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/105105105

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Students are asked to prepare the models showing the reinforcement details in singly reinforced, doubly reinforced beams, Columns, Staircases and footings.

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V Semester

GEOTECHNICAL ENGINEERING			
Course Code	21CV54	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assess the improvement in mechanical behavior by densification of soil deposits using compaction.
5. Model and measure strength-deformation characteristics and bearing capacity of soils

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Video tube, NPTEL materials
2. Quiz/Assignments/Open book test to develop skills
3. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

Module-1	
Introduction : Phase Diagram, phase relationships, definitions and their inter relationships. Determination ofIndex properties: Specific gravity, water content, in-situ density, relative density, particle size analysis, Atterberg's Limits, consistency indices. Activity of clay, Field identification of soils, Plasticity chart, BIS soil classification. (08 Hrs)	
Teaching-Learning Process	Chalk and talk, PPT presentations, Youtube videos, visit to near by sites
Module-2	
Permeability: Darcy"s law- assumption, coefficient of permeability and its determination in laboratory, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation **Effective Stress** Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena. (08 Hrs)	
Teaching-Learning Process	Chalk and talk, PPT presentations, Youtube videos, visit to near by sites
Module-3	
Compaction: Principle of compaction,Standard and Modified proctor's compaction tests,factors affecting compaction,effect of compaction on soil properties. **Consolidation:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption, Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test. characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio. (08 Hrs)	
Teaching-Learning Process	Chalk and talk, PPT presentations, Youtube videos, visit to near by sites
Module-4	
Shear Strength: Concept of shear strength, Mohr–Coulomb Failure Criterion, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test, Tests under different drainage conditions. (08 Hrs)	
Teaching-Learning Process	Chalk and talk, PPT presentations, Youtube videos, visit to near by sites
Module-5	

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Bearing Capacity of Soil: Determination of bearing capacity byTerzaghi's and BIS method(IS:6403),Modes of shear failure,Factors affecting Bearing capacity of soil.Effects of water table and eccentricity on bearing capacity of soil.

Foundation Settlement:Types of settlements and importance, Computation of Immediate, consolidation and creep settlements, permissible, differential and total settlements. (08 Hrs)

Teaching-Learning Process	Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Determine the index properties of soil and hence classify the soil
2. Assess the compaction and consolidation characteristics of soil
3. Determine the permeability of soils and assess the seepage in hydraulic structures
4. Evaluate shear parameters of the soil using shear tests
5. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. PunmiaB.C.,"SoilMechanics and FoundationEngineering,LaxmiPublicationsCo.,India.
2. Braja,M.Das,"Principles of Geotechnical Engineering",Cengage Learning,India
3. MurthyV.N.S.,"Geotechnical Engineering:Principles and Practices of Soil Mechanics and Foundation Engineering",CRCPress, NewYork

ReferenceBooks:

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1. BowlesJ.E.,"Foundation Analysis and Design",McGrawHillPub.Co.NewYork.
2. SwamiSaran,"Analysis and Design of Substructures",Oxford&IBHPub.Co.Pvt.Ltd.,India.
3. R.B.Peck,W.E.Hanson&T.H.Thornburn,"Foundation Engineering",WileyEastern Ltd.,India.
4. DonaldP.Coduto,"Geotechnical Engineering Principles&Practices",Prentice-hall of IndiaLtd,India.
5. Bureau of Indian Standards:IS-1904,IS-6403,IS-8009,IS-2950,IS-2911and all other relevant codes.

Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of field equipment's to learn the onsite field test of soil
- Visit to a site and learn importance of soil investigation

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GEOTECHNICAL ENGINEERING LABORATORY			
Course Code	21CVL55	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0+0+2	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This course will enable students to

1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

Sl.NO	Experiments
1	Specific gravity test(pycnometer and density bottle method).Water content determination by oven drying method
2	Grain Size Analysis Sieve Analysis
3	In-situ density tests Core-cutter method Sand replacement method
4	Consistency limits Liquid limit test (by casagrande's and cone penetration method) Plastic limit test
5	Standard compaction test(light and heavy compaction)
6	Co-efficient of permeability test Constant head test Variable head test
7	Shear strength tests Unconfined compression test Direct shear test Triaxial test (unconsolidated undrained test only)
8	Consolidation test: to determine preconsolidation pressure only(half an hour perloading-test).
	Demonstration Experiments (For CIE)
9	Field identification of soil
10	Hydrometer analysis,
11	Rapid moisturemeter method.
12	Shrinkage limit test,
13	Swell pressure test,
14	Standard penetration test and boring equipment
15	laboratory vane shear test

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Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD. plan and assess field compaction program
4. Shear strength and consolidation parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics(SPT-Demonstration)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks.**

The split-up of CIE marks for record/ journal and test are in the ratio **60:40.**

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer

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script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:
ReferenceBooks:

1. PunmiaBC,SoilMechanicsandFoundationEngineering-(2017),16thEdition,LaxmiPublicationsco.,NewDelhi.
2. LambeT.W.,"SoilTestingforEngineers",WileyEasternLtd.,NewDelhi.
3. HeadK.H.,"ManualofSoilLaboratoryTesting"Vol.I,II,III,PrincetonPress
4. BowlesJ.E.,"EngineeringPropertiesofSoilandTheirMeasurements",-McGrawHillBookCo.NewYork.
5. RelevantBISCodesofPractice:IS-2720series

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V Semester

Environmental Studies			
Course Code	21CIV57	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0+2+0+0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02

Course objectives:

- To create the environmental awareness among the students.
- To gain the knowledge on different types of pollution in the environment.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Environmental awareness programme for the in house campus
3. Encourage collaborative (Group Learning) Learning in the class.
4. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1	
Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	
Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools
Module-2	
Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.	
Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools
Module-3	
Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. **Waste Management & Public Health Aspects**: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.	
Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools
Module-4	

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Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools

Module-5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Question paper pattern:

1. The Question paper will have 100 objective questions.
2. Each question will be for 01 marks
3. Student will have to answer all the questions in an OMR Sheet.
4. The Duration of Exam will be 2 hours

Suggested Learning Resources:

Books

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018

Reference Books:-

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Text book of environmental science and Technology, BS publications 2007

Dr. B.S Chauhan, Enivironmental studies, university of science press 1st edition

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
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V Semester

RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS			
Course Code:	21CV56	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1+2+0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	02

Course Objectives:

CO1. T o Understand the knowledge on basics of research and its types.
CO2. T o Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
CO3. To learn Ethics in Engineering Research.
CO4. T o Discuss the concepts of Intellectual Property Rights in engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effectiveteaching methods could be adopted to attain the outcomes.
2. Use of Video to explain various concepts on IPR.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Introduce Topics in manifold representations.
6. Show the different ways to analyze the research problem and encourage the students to come up withtheir own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps Improve the students' understanding.

Module-1

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem.

Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Teaching-LearningProcess	Chalk and talk method / PowerPoint Presentation.

Module-2

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.

Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.

Teaching-	Chalk and talk method / PowerPoint Presentation
Learning Process	

Module-3

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Building Intellectual Property Rights, Law of Patents, **Fundamentals of Patent Law** - Evolution of the patent system, Patentability Requirements; Patentable Subject Matter; Industrial Applicability/Utility; Novelty; Anticipation by publication; Anticipation by public knowledge and public use; Anticipation by public display; Anticipation by sale; Inventive Step/Non-Obviousness; Novelty Assessment; Inventive Step Assessment; Specification, **Drafting of A Patent Specification** - Introduction Patent Specification; Provisional Specification Complete Specification, Parts of the complete specification; **Patent Procedure in India** - PATENT PROCEDURE; Registration and Renewal fee payment; **Patent Infringement** - Infringement of a patent; Literal Infringement; Equivalence Infringement; Indirect Infringement; Defenses - Experiment - Research or Education - Bolar Exemption- Government use- Patent Exhaustion- Patent Misuse- Inequitable Conduct - Remedies- Injunction- Account of profits- Costs; **International Patent Regimes** - International Instruments; Paris Convention; TRIPS AGREEMENT; PCT; BUDAPEST TREATY, **Patenting Biotechnology Inventions** - Unique nature of Biotechnology; Patentability Requirements and Biotechnology Inventions; Patentable Subject Matter- USA- Europe- India; **Patentability of Software Inventions** - Patentability of Software Inventions in USA; Patentability of software inventions in Europe; Patentability of Software Inventions in India.

Teaching- Learning Process	Chalk and talk method / PowerPoint Presentation.

Module-4

Law of Copyright and Designs, Understanding Copyright Law - Historical Overview – Justification For Copyright Law - The Natural Law Justification - The Economic Rationale of Copyright Clause, Basic Concepts Underlying copyright Law - Idea – Expression Dichotomy Originality / Creativity – Fixation **Term of Protection, Subject - Matter of Copyright** - Literary Works - Dramatic Works - Musical Work - Artistic Works - Cinematograph Films and Sound recordings, **Acquisition of Copyright in India**, Rights of the Copyright Owner - Economic Rights - Moral Right or Droid Moral Right of Authorship or Paternity Rights - Rights against Distortion or Mutilation of the Original Works or Integrity Rights - Limitations - Limitations set under International Regime – Berne Convention - Rome Convention - Trips Agreement - Three Step Test, Infringement of Copyright -Transfer of copyright - License and Assignment - License and consent -Duration of a License Form and Content - Disputes in Respect of Licence -Types of Licenses - Exclusive and Non-Exclusive Licenses.

Basic Principles of Design Rights - Justification for Protecting Designs - Historical Perspective - Features of Shape, configuration, Pattern or Ornament - or Composition of lines or colour - New or Original - Applied to an Article, **Excluded Subject - Matter** - Method or Principle of Construction - Features Dictated Solely by Function - Mechanical Device - Trademark, or Property Mark, or Artistic Work - immoral Designs and Designs Contrary to Public order–**Rights of the Owner of Designs and Tests for Infringement. Assignment of Design Rights, Infringement of Designs.**

Teaching- Learning Process	Chalk and talk method / PowerPoint Presentation

Course Outcomes (Course Skill Set)

At the end of the course the student will be able to:

CO 1. To know the meaning of engineering research.
CO 2. To know the procedure of Literature Review and Technical Reading.
CO 3. To know the fundamentals of patent laws and drafting procedure.
CO 4. Understanding the copyright laws and subject matters of copyrights and designs
CO 5. Understanding the basic principals of design rights.

Suggested Learning Resources:

Textbook

1. Dipankar Deb • Rajeeb Dey, Valentina E. Balas "Engineering Research Methodology", ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0

Reference Book:

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4 -

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

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Semester V

Data Analysis with Python			
Course Code	**21CV581**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	1 hr

Course objectives:

- To install Python package and Iris data set
- To understand supervised and unsupervised learning
- To understand regression analysis

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Video tube, NPTEL materials
2. Quiz/Assignments/Open book test to develop skills

Module-1

Introduction to scikit-learn Python package, Iris data set.

Getting and processing data: CSV files, Pandas package, Feature selection, Online data sources.

Teaching-Learning Process	Chalk and talk, PPT, You Tube Video lectures

Module-2

Data visualization using Matplotlib, Plotly.

Supervised and Unsupervised learning

Teaching-Learning Process	Chalk and talk, PPT, You Tube Video lectures.

Module-3

Regression: Simple linear regression, Multiple linear regression, Decision tree, Random forests.

Teaching-Learning Process	Chalk and talk, PPT, You Tube Video lectures

Module-4

Classification: Logistic regression, K-nearest neighbours, Decision tree classification, Random forests classification.

Clustering: Goals and uses of clustering, K-means clustering, Anomaly detection, Association rule learning.

Teaching-Learning Process	Chalk and talk, PPT, You Tube Video lectures

Module-5

Artificial neural networks: Definition, Example, Potential and constraints.

Teaching-Learning Process	Chalk and talk, PPT, You Tube Video lectures

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Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Use online data sources for solving problems
2. Solve statistical problems and interpretation of results
3. Data visualization and graphical representation for decision making
4. Solve problems using artificial neural networks

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be scaled down to 50 marks

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Peters Morgan, Data Analysis with Python, AI Sciences, 2016.
2. Wes McKinney, Python for Data Analysis, O'Reilly Media,

Web links and Video Lectures (e-Resources):

- Online study material
- Video lectures.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Assignment to students to solve a real problem

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Semester V

Software Applications			
Course Code	21CV582	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0::2:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	1 hr

Course objectives:

- To understand the types of trusses
- Modelling and analysis of trusses adopting codal provisions
- Analysis and design of multi-storied structures

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Video tube, NPTEL materials
2. Quiz/Assignments/Open book test to develop skills

Module-1

Categorization of structures based on number of dimensions, types of member connectivity, type of elements (1D truss/beam element, 2D plane stress/plane strain, and plate elements, 3D solid elements), structure degrees of freedom, boundary conditions, stiffness matrix, load vector, displacements, stiffness equation, degree of freedom numbering for a structure.

Global or structure coordinate system, Local or element coordinate system, element degrees of freedom, Element forces and Material properties for different types of elements.

Teaching-Learning Process	Chalk and talk, PPT, You Tube video lectures

Module-2

Modeling 2D and 3D skeletal structures (truss and frame) in software: Node coordinates, member connectivity, supports. Representing slabs using rigid diaphragms and/or master and slave nodes.

Nodal loads and element loads, Independent load cases, Load combinations, self weight of structural elements, calculation and verification of gravity loads including self weight

Teaching-Learning Process	Chalk and talk, PPT, You Tube video lectures.

Module-3

Analysis and interpretation of results by studying support reactions, bending moment and shear force diagrams of elements.

Identifying critical cross-sections for design of beam and column elements, Grouping of elements based on structural behaviour and similarity of geometry and member design forces

Teaching-Learning Process	Chalk and talk, PPT, You Tube video lectures

Module-4

Modelling 2D plane trusses with Indian Standard steel sections, analysis for gravity and wind loads as per Indian Standard codes, design check for selected cross-section as per IS 800:2007, identifying failed elements and revising cross-section to make element safe.

Modelling simple 3D frame structures up to 4 storeys with reinforced concrete cross-sections, analysis for gravity and wind loads as per Indian Standard codes, verification of weight of building by

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hand calculation with reactions obtained from analysis, load combinations, interpretation of results, grouping of elements, design of typical elements and foundation as per IS 456:2000.

Teaching-Learning Process	Chalk and talk, PPT, You Tube video lectures

Module-5

Modelling steel gabled frames for industrial structures with Indian Standard steel sections, analysis for gravity and wind loads as per Indian Standard codes, design check for selected cross-section as per IS 800:2007, identifying failed elements and revising cross-section to make element safe.

Teaching-Learning Process	Chalk and talk, PPT, You Tube video lectures

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Determine the forces in the truss members
2. Analyse and design the truss
3. Analyse and design industrial structures

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is

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MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. IS 875 Parts 1, 2 and 3: 1987
2. IS 456:2000
3. IS 800:2007
4. STAAD Pro v8i user manual
5. SAP2000 user manual

Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Assignment to students to design an industrial roof truss

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Gender Sensitisation (AEC)			
Course Code	21CV583	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	1

Course objectives: Enable the students to

1. Figure out the current practices of a patriarchal society.
2. Balance the roles and responsibilities of different genders in a civil society.
3. Appreciate the importance of family and the values it stands for.
4. Balance gender issues and emphasise on gender equality at work place and society.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Power point Presentation, video

Module-1

Understanding Gender and Related Concepts, Gender in Everyday Life, Gender of Work

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation

Module-2

Gender and Sexualities, Masculinities, Family, Love and Power Marriage, Motherhood.

Teaching-Learning Process	Chalk and talk, Practice sessions.

Module-3

Gendering Work, Gender and Employment , Gender Issues in Work and Labour Market, Sexual Harassment at the Workplace

Teaching-Learning Process	Chalk and talk, .

Module-4

Health in Social Contexts, Reproductive Health and Rights, Gender and Disability. Gender- Based Violence

Teaching-Learning Process	Chalk and talk, Activity

Module-5

Towards Gender Equality.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Appreciate gender issues prevalent in the society.
2. Value the role of each gender in family, society and state.
3. Analyse the gender sensitivity at work place and evolve proper perception of the other gender.
4. Sensitise oneself towards gender equality.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. IGNOU : Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi.
2. Jane Pilcher and Imelda Whelehan (2005) : Fifty Key Concepts in Gender Studies.

Web links and Video Lectures (e-Resources):

- Online resources

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Presentation on any social issues

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V Semester

Quality Control and Quality Assurance			
Course Code	21CV584	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	1

Course objectives: Enable the students to

1. Appreciate the concept of Quality
2. Articulate the Implication of Quality in construction
3. Implement QA & QC Programs
4. Realise the importance of QMS in Civil Engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Power point Presentation, video
3. Site Visit
4. Industry interaction

Module-1

Overview of Quality: Quality History, Quality Definition, Quality Inspection, Quality Control, Quality Assurance, Quality Engineering, Quality Management, Quality Gurus: Philip B. Crosby, W. Edwards Deming etc, PDCA Cycle, Costs associated with Quality, Reasons for Poor Quality

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation

Module-2

Quality Management: Management Practices: TQM, Vision and Quality policy, Quality Function Deployment, Bench marking and performance evaluation, ISO 9000 Quality Management System, ISO 14000 Environmental Management System

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation.

Module-3

Statistical Quality Control: Importance of SQC in construction, Statistical parameters: sampling, population and sampling, measure of variability, measure of central tendency, Recommendations of IS 456:2000 on sampling, testing and acceptance criteria for concrete.

Teaching-Learning Process	Chalk and talk, Demonstration.

Module-4

QA and QC in Construction: Errors in concrete construction; Frequency of material testing and reporting of basic construction materials (cement, sand, coarse aggregate, bricks, steel), Norms for accepting and rejecting criteria of basic construction materials as per relevant IS codes.

Teaching-Learning Process	Chalk and talk, Enacting, Site Visit

Module-5

On-Site Quality: Achieving quality at different stages of construction: Conceptual Design, Preliminary Design, Detailed Design, Construction, Testing, Commissioning, and Handover. Quality assessment of concrete through NDT: rebound hammer and USPV tests and guidelines for accepting and rejecting.

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Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, Industry Interaction

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Realize the importance of quality in construction
2. Apply SQC techniques in different aspects of construction
3. Implement QMS programs at different levels of construction

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 01 hour)**

1. The question paper will have 50 questions of 2 marks each.
2. There will be 10 questions from each module. The students have to answer all questions.

Total of 100 marks of SEE will be scaled down to 50 marks

Suggested Learning Resources:

Books

1. Juran J M and Gryna F M, Quality Planning and Analysis
2. Hutchins G, John L Ashford, The Management of Quality in Construction
3. Mohamed A. El-Reedy, "Concrete and Steel Construction, Quality Control and Assurance", CRC Press, Taylor and Francis Group
4. Amitava Mitra, Fundamentals of Quality Control and Improvement, WILEY Publications, 4th Edition
5. Abdul Razzak Rumane, Quality Management in Construction Projects, CRC Press, Taylor and Francis Group
6. M. S. Shetty, Concrete Technology, S Chand Publications
7. Relevant IS Codes

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Web links and Video Lectures (e-Resources):
• Online study material • You Tube videos
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
• Demonstrations of Videos • Industrial visit – preparation of checklists for different activities in construction • Collection of typical reports on testing of basic construction materials

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V Semester

Offshore Structures			
Course Code	21CV585	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	1

Course objectives:

- To understand the different types of offshore structure
- To learn the concept of offshore structural design
- To understand various effects on offshore strucutures

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Manuals and code books for offshore structures
2. Power point presentations
3. YouTube videos

Module-1

Types of offshore structures and their conceptual development- Fixed, Compliant, Floating-Analytical models for offshore structures- Behaviour under static and dynamic loads- Materials and construction of jacket and gravity platforms- Statutory regulations- Allowable stresses- Design methods and Code Provisions- Design specification of API, DNV, Lloyd's and other Classification Societies.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-2

Environmental loads- Wind, wave, current and ice loads- Calculation based on maximum base shear and overturning moments- Design wave height and spectral definition- Morison's Equation-Maximum wave force on offshore structure

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-3

Concept of return waves- Principles of static and dynamic analyses of fixed platforms-Use of approximate methods- Principles of WSD and LRFD- Allowable stresses and partial safety factors-Design of structural elements.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-4

Design against accidental loads- Fire, Blast and Collision- Behaviour of steel at elevated temperature. Fire rating for Hydrocarbon fire- Design of structures for high temperature- Blast mitigation-Blast walls- Collision of boats and energy absorption. 8 hours

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Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-5

Corrosion- Corrosion mechanism- Types of corrosion- Offshore structure corrosion zones- Biological corrosion- Preventive measures of corrosion- Principles of cathode protection systems- Sacrificial anode method and impressed current method- Online corrosion monitoring- Corrosion fatigue.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Acquire knowledge and skills to carry out basic tasks regarding dimensioning and structural design of offshore structures.
2. Estimation of maximum forces on an offshore structure due to operational loads and conduct static and dynamic analyses of fixed platforms.
3. Acquire training in the design of jacket platforms, gravity platforms.
4. Estimate the resistance of platforms against fatigue and accidental loads.
5. Attain knowledge in the physics of corrosion and methods to monitor and prevent corrosion.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

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Suggested Learning Resources:

Books

1. Srinivasan Chandrasekaran. Dynamic Analysis and Design of Ocean Structures. Springer, 2015.
2. DNV-RP-C203- fatigue Design of Offshore Steel Structures, 2011.
3. DNV-RP-C204- Design against Accidental Loads, 2010.
4. DNV-RP-B101-Corrosion Protection of Floating Protection and Storage Units, 2007.
5. API RP 2A. Planning, Designing and Constructing Fixed Offshore Platforms, API. 2000.
6. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
7. Clauss, G, Lehmann, E &Ostergaard, C, Offshore Structures, Vol. 1 & 2, Springer-Verlag, 1992.
8. Reddy, D. V and Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ. Co.1991.
9. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
10. McClelland, B and Reifel, M. D., Planning and Design of fixed Offshore Platforms, Van Nostrand, 1986.
11. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
12. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.

Web links and Video Lectures (e-Resources):

- YouTube videos

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Experiments to understand fire resistance of materials
- Experiments to understand corrosion resistance of materials
- Modelling of offshore structures to understand various components

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VI Semester

CONSTRUCTION MANAGEMENT AND ENTRPRENERSHIP			
Course Code	**21CV61**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Course objectives:

This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties
4. Develop an entrepreneurial outlook and mind set along with critical skills and knowledge to manage risks associated with entrepreneurs.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans.

Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles.

Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path critical path method, PERT method, concept of activity on arrow and activity on node.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Resource Management: Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity. **Construction Equipments:** classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance **Materials:** material management functions, inventory management.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

Construction Quality , safety and Human Values: Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management **HSE: Introduction** to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.

Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

Teaching-Learning	1.Blackboard teaching/PowerPoint presentations (if needed)

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Process	2.Regular review of students by asking questions based on topics covered in the class.

Module-4

Introduction: Principles of Engineering Economy, Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Interest and Interest Factors: Interest rate, Simple interest, Compound interest, Cash- flow diagrams, Exercises and Discussion.

Comparison of alternatives: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.

Replacement Analysis: Replacement studies, replacement due to deterioration, obsolescence, inadequacy, economic life for cyclic replacements, Exercises, Problems. Break- Even Analysis: Basic concepts, Linear Break- Even analysis, Exercises, Problems.

Depreciation: Causes of Depreciation, Basic methods of computing depreciation charges, Exercises, Problems.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-5

Introduction to Entrepreneurship – Learn how entrepreneurship has changed the world. Identify six entrepreneurial myths and uncover the true facts. Explore E-cells on Campus **Listen to Some Success Stories**: - Global legends Understand how ordinary people become successful global entrepreneurs, their journeys, their challenges, and their success stories. Understand how ordinary people from their own countries have become successful entrepreneurs.

Characteristics of a Successful Entrepreneur Understand the entrepreneurial journey and learn the concept of different entrepreneurial styles. Identify your own entrepreneurship style based on your personality traits, strengths, and weaknesses. Learn about the 5M Model, each of the five entrepreneurial styles in the model, and how they differ from each other. Communicate Effectively: Learn how incorrect assumptions and limiting our opinions about people can negatively impact our communication. Identify the barriers which cause communication breakdown, such as miscommunication and poor listening, and learn how to overcome them.

Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1.Understand various management principles of construction industry (L2)

2.Use planning, organizing, scheduling, monitoring and controlling techniques for managing construction activity (L4)

3.Understand importance of quality control and safety in construction.(L2)

4. Understand managing data pertaining to construction project. (L4)

5. Evaluate alternatives and develop capital budget for different scenarios.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education

2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw Hill Publishing Company, New Delhi.

3. Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of PearsonEducation

4. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.

5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:

5. Engineering Economy, Riggs J.L., 5th Edition, Tata McGraw Hill, ISBN 0-07-058670-5

6. Engineering Economics, R Panneerselvam, Eastern Economy Edition 2001, PHI, ISBN – 81- 203-1743-2.

7. Cost Accounting, Khan M Y, 2nd Edition, 2000, Tata McGraw-Hill, ISBN 0070402248

8. Mechanical Estimating & Costing, T.R.Banga, S.C.Sharma, 16th Edition, 2011, Khanna Publishers, ISBN 8174091009

Web links and Video Lectures (e-Resources):

- Online study material
- You Tube video lectures

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quizz(To assist in GATE Preparations
- Self Study on simple topics
- Case Study Presentation

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VI Semester -

CONCRETE TECHNOLOGY			
Course Code	21CV62	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	3

Course objectives:

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

MODULE-1

CEMENT AND AGGREGATES

Cement, Chemical composition, Physical and chemical properties, Other Cementitious materials and composition -GGBS, Fly ash rice Husk ash, Silica fume, Hydration of cement, Factors influencing and affecting Hydration of cement, Types of cement. Fine aggregate - grading, analysis, Specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. Codal Provisions.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

MODULE-2

FRESH PROPERTIES OF CONCRETE

Workability - Process of manufactures of concrete: Batching, Mixing, Assessment of Workability of Concrete, Factors affecting workability, Measurement of workability – slump test, flow test, Compaction factor test and Vee-Bee Consistometer tests, Segregation and bleeding, Transporting, Placing, Compaction, Curing, need and Types of curing, accelerated curing.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

MODULE-3

ADMIXTURES: Classification, effect on fresh and hardened concrete, retention time, Dosage ant their effects, Influence on properties of paste, mortar, and concrete Types of concrete (in brief).

MIX DESIGN PROCEDURE: Concept of Concrete Mix design, variables in proportioning, exposure conditions, Procedure of mix design as per IS 10262-2019, Numerical examples of Mix Design. Highlights of Other methods of Mix Design as per other codes.

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Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

MODULE-4

HARDENED CONCRETE:

Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, assessment of compressive strength, flexural strength, tensile strength, bond strength and modulus of elasticity, aggregate - cement bond strength, factors influencing strength and codal provisions, Relation between modulus of elasticity and strength, factors affecting modulus of elasticity, Poisson Ratio.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

MODULE 5

Durability - definition, significance, short term and long-term durability. Shrinkage - plastic shrinkage and drying shrinkage, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, Factors affecting shrinkage, Effect of creep. Measurement of creep, factors influencing creep. Permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Construction joints and Expansion joints, Thermal effect of concrete. Codal Provisions.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Testing of cement: Consistency, fineness, setting time, Specific Gravity, Soundness and strength.
2	Testing of fine aggregate: Specific Gravity, sieve analysis and zoning, bulking of fine aggregate, bulk density, silt content.
3	Testing of coarse aggregate: Specific Gravity, sieve analysis, bulk density, flakiness index, elongation index, water absorption & moisture content, soundness of aggregate.
4	Concrete Mix design by ACI 211.1-91 method, IS code method as per 10262- 2019 & 456-2000, DOE method
5	Tests on Concrete- Workability tests – Slump cone test, compaction factor test, Vee-bee consistometer test, flow table test, strength tests- compressive strength, flexural strength, split tensile strength
6	Effects of Admixture - Accelerator, Retarder, Super Plasticizer
7	Non-destructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Assess and infer various properties of cement, cementitious materials, Fine and coarse aggregate as per codal provision and specifications (L2)
2. Design the concrete mix for the given materials as per IS:10262-2019 provisions (L4)
3. Understand the manufacturing process and asses the quality of green (L2)

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4. Describe the properties of fresh and hardened concrete – Strength and Durability aspects (L3)
5.Examine and Evaluate properties of Cement and Concrete

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour)**

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks.**

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 02/03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks.**

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from

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the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1.M.S.Shetty , "Concrete Technology" - Theory and Practice, , S.Chand and Company, New Delhi, 2002.

2. Concrete Technology (Trade, Technology & Industry), George White, Delmar Pu

3.Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta , Paulo J. M. Monteiro, McGraw-Hill Education

4.Neville, A.M. , Properties of Concrete": , ELBS, London

5.A.R.Santakumar , "Concrete Technology" –. Oxford University Press (2007)'

6.Advanced Concrete Technology, Zongjin Li, Wiley; 1 edition

7.GambhirDhanpatRai&Sons , "Concrete Manual" -, New Delhi

8.N.KrishnaRaju, "Concrete Mix Design" -, Sehgal - publishers

9.IS:10262-2016 , "Recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi

Web links and Video Lectures (e-Resources):

Cement https://nptel.ac.in/courses/105102012/1
Aggregates https://nptel.ac.in/courses/105102012/6
Mineral admixtureshttps://nptel.ac.in/courses/105102012/11
Chemical admixtures https://nptel.ac.in/courses/105102012/9
https://nptel.ac.in/courses/105102012/10
Concrete mix design https://nptel.ac.in/courses/105102012/14
Concrete production & fresh concrete https://nptel.ac.in/courses/105102012/19
Engineering properties of concretehttps://nptel.ac.in/courses/105102012/23
Dimensional stability & durability https://nptel.ac.in/courses/105102012/27
Durability of concrete https://nptel.ac.in/courses/105102012/31
Special concretes https://nptel.ac.in/courses/105102012/36

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quizz(To assist in GATE Preparations
- Demonstrations in Lab
- Self Study on simple topics
- Simple problems solving using Excel
- Virtual Lab Experiments

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VI Semester

DESIGN OF STEEL STRUCTURAL ELEMENTS			
Course Code	21CV63	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge

Module-1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-2

Bolted Connections: Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)and bracket connections.

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-3

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design concept of Laced and Battened Systems.

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Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members. Concept of Lug angles, Splices and Gussets.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-5

Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

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Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi

Reference Books:

1. Dayarathnam P, "Design of Steel Structures", Scientific International Pvt. Ltd.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

Web links and Video Lectures (e-Resources):

- Video Lectures https://nptel.ac.in/courses/105105162
- Lecture Notes https://nptel.ac.in/courses/105106112.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Students are asked to prepare models of different connections, compression members, built-up columns, column bases.
- Students are asked to prepare a report after visiting the industrial structure construction site.

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VI Semester

DESIGN OF PRE-STRESSED CONCRETE structures			
Course Code	21CV641	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: This course will enable students

- To understand Concepts of pre stressing
- To understand Materials used in Pre stressed concrete technology
- To analyse and design Pre stressed concrete structural elements

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. PPT's with good examples
3. You Tube video lectures
4. NPTEL or online study material.

Module-1

Introduction and Analysis of Members: Concept of Pre stressing - Types of Pre stressing - Advantages - Limitations –Pre stressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete. Comparison between RCC & PSC.

Analysis of members at transfer - Stress concept - Force concept - Load balancing concept - Kern point -Pressure line. (More problems on stress concept)

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-2

Losses in Pre stress: Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.

Deflection: Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for simply supported beams.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-4

Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-5

Different anchorage system and design of end block by latest IS codes.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

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Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the requirement of PSC members for present scenario.
2. Analyse the stresses encountered in PSC element during transfer and at working.
3. Understand the effectiveness of the design of PSC after studying losses
4. Capable of analyzing the PSC element and finding its efficiency.
5. Design PSC beam for different requirements.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Krishna Raju, N. "Pre stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006
2. Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
3. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi

Reference Books:

1. Praveen Nagarajan, "Advanced Concrete Design", Person Publishers
2. P. Dayaratnam, "Pre stressed Concrete Structures", Scientific International Pvt. Ltd.
3. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York
4. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi

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5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.
6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures
- You Tube videos.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to a Pre stressing structural elements manufacturing yard and students have to submit a report

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VI Semester

APPLIED GEOTECHNICAL ENGINEERING			
Course Code	21CV642	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geo-technology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. PPT
3. You Tube video lectures
4. Open book test to understand the concepts.

Module-1

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits,Borings, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, sample disturbance and Bore hole log.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-2

Drainage and Dewatering: Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev'smethod) **Flownets:** Importance, properties and applications, Phreatic Lines, Seepage in earth dams (with and without filter)and sheet piles.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless andcohesive soils, Factors influencing lateral earth pressure, Geotechnical design of gravity and cantilever retaining walls.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-4

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Stability of Slopes: Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts. Causes for slope instability, Methods of stabilisation of slopes

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-5

Stresses in Soil: Geodesic stress and Stress due to structures, Boussinesq's Stress distribution in ground forpoint load, line load and uniformly distributed loads, Newmark's Chart, Contact Pressure, Pressure bulbs

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Abilitytoplanandexecutegeotechnicalsiteinvestigationprogramfordifferentcivilengineeringprojects
2. Understandingofstressdistributionandresultingsettlementbeneaththeloadedfootingsonsandandclayeys oils
3. Abilitytoestimatefactorofsafetyagainstfailureofslopesandtocomputelateralpressuredistributionbehind earth retainingstructures
4. Abilitytodeterminebearingcapacityofsoilandachieveproficiencyinproportioningshallowisolatedandco mbinedfootingsforuniformbearingpressure
5. Capableofestimatingloadcarryingcapacityofsingleandgroupofpiles

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

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Suggested Learning Resources:

Books

Textbooks

1. MurthyV.N.S.,Principles of Soil Mechanics and Foundation Engineering,UBS PublishersandDistribu tors,NewDelhi.
2. K.R.Arora,Soil Mechanics and FoundationEngineering,StandardPublisherDistributors,NewDelhi.
3. PCVarghese,FoundationEngineering,PHIIndiaLearningPrivateLimited,NewDelhi.
4. PunmiaBC,SoilMechanicsandFoundationEngineering- (2017),16thEdition,LaxmiPublicationsco.,NewDelhi.

ReferenceBooks

1. T.W.LambeandR.V.Whitman,SoilMechanics-,JohnWiley&Sons.
2. DonaldPCoduto,GeotechnicalEngineering-PhiLearningPrivateLimited,NewDelhi.
3. ShashiK.Gulathi&ManojDatta,GeotechnicalEngineering-.,TataMcGrawHillPublications.
4. DebashisMoitra,"Geotechnical Engineering",UniversitiesPress.,
5. MalcolmDBolton,"AGuidetosoilmechanics",UniversitiesPress.,
6. BowlesJE,Foundation analysis and design,McGraw-HillPublications.
7. Bureauof Indian Standards:IS-1904,IS-6403,IS-8009,IS-2950,IS-2911and all other relevant codes.

Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Site visit to understand the practical difficulty in construction of earth retaining strucures
- Assignment to students on design of an earth retaining structures

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VI Semester

RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS			
Course Code	21CV643	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Understand the history and development, role of railways, railway planning and development based onessential criteria.
- Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction.
- Understand various aspects of geometrical elements, points and crossings, significance of maintenance of tracks.
- Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visualaids
- Apply design features of tunnels, harbors, dock and necessary navigational aids; also expose them to variousmethods of tunneling and tunnel accessories.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability

– Elements of permanent way, - Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails

Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right- and Left-hand turnouts only).

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbours: Requirements,Classification, Location and Design

Principles – Harbour Layout and Terminal Facilities, Coastal Structures, Inland Water Transport – Wave action onCoastal Structures and Coastal Protection Works.

Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-4

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Airport Planning: Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-5

Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and
Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of TaxiwayDesign, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway andtaxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determinethe hauling capacity of a locomotive.
3. Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify requiredtype of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunnelling activities.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3

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sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M. M,"Railway Engineering", 2nd Edition, Oxford University Press ,New Delhi.
3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemch and and Brothers, Roorkee.
4. CVenkatramaiah, "Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press.
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.

Web links and Video Lectures (e-Resources):

- . https://nptel.ac.in/courses/105107123

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Simple problems solving using Excel

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VI Semester

Design Concepts in Building Services			
Course Code	21CV644	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Course objectives:

- Learn the importance of sanitation, domestic water supply, plumbing and fire services
- Understand the concepts of heat, ventilation and air conditioning
- Develop technical and practical knowledge in Building Services.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills .
2. Encourage collaborative (Group Learning) Learning in the class.
3. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1

Water Supply, Drainage and Solid Waste Disposal: Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods 8 Hours

Teaching-Learning Process	Chalk and talk, powerpoint presentation

Module-2

Heat Ventilation and Air Conditioning (HVAC): Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system. 8 Hours

Teaching-Learning Process	Chalk and talk, powerpoint presentation

Module-3

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Electrical and Fire Fighting Services: Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice , planning electrical wiring for building. Main and distribution boards, Principles of illumination, Classification of buildings based on occupancy, causes of fire and spread of fire. Standard fire. Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Provisions of NBC. 8 Hours	
Teaching-Learning Process	Chalk and talk, powerpoint presentation
Module-4	
Plumbing and Fire Fighting Layout of Simple Buildings: Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc. 8 Hours	
Teaching-Learning Process	Chalk and talk, powerpoint presentation
Module-5	
Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems. Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators, Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions. 8 Hours	
Teaching-Learning Process	Chalk and talk, powerpoint presentation
Course outcome (Course Skill Set) At the end of the course the student will be able to : 1. Describe the basics of house plumbing and waste water collection and disposal. 2. Discuss the safety and guidelines with respect to fire safety. 3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting. 4. Understand and implement the requirements of thermal comfort in buildings	

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

3. National Building Code
4. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
5. Kamala & DL Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
6. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
7. M.David Egan, Concepts in Building Fire Safety.
8. O.H.Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom
9. V.K.Jain, Fire Safety In Building 2edition, New Age International Publishers
10. E.G.Butcher, Smoke control in Fire-safety Design.
11. E.R.Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York
12. Handbook for Building Engineers in Metric systems, NBC, New Delhi

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in
- https://swayam.gov.in

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Assignment to students on building service components

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VI Semester

Groundwater Hydraulics			
Course Code	21CV645	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course Objectives

1. Explain the Significance of Groundwater
2. Paraphrasing the characteristics of aquifers
3. To quantify the Groundwater flow by different methods
4. To locate occurrence of groundwater and synthesize groundwater development

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Power point presentation, Video
2. Quiz, assignments, Seminars to develop skills
3. Video, Utube, NPTTEL materials
4. Encourage collaborative learning in the class
5. Adopt problem Based learning(PBL) to develop analytical and thinking skills
6. Pumping test demonstration at Near by site s and Testing of water quality

Module-1	
Importance of Groundwater, Vertical distribution of groundwater, Occurrence in different types of rocks and soils Definition of -Aquifers, Aquifuge, Aquitard , Aquiclude ,Confined and Unconfined aquifer Fundamentals of Ground water flow-Aquifer parameters, specific yield and specific retention, porosity, storage coefficient.	8 hours
Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-2	
Derivation of Darcy's law, Hydraulic conductivity, coefficient of permeability and Intrinsic permeability Permeability in isotropic , anisotropic soils, Steady One dimensional flow	8 hours
Teaching-Learning Process	Chalk and Talk, Power point presentation ,analysis in laboratory

Module-3	
Well Hydraulics-Steady flow Steady Radial flow in confined aquifer and Unconfined aquifer, derivation – Theiss method, Cooper and Jacob Method Solutions for Unsteady flow equations, interference of wells, image well theory	8 hours
Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-4	
Groundwater exploration and Development - Seismic, Electrical resistivity, Geophysical techniques Groundwater exploration by different logging techniques-Electrical Logging, induction logging, Groundwater Development-Types of Wells, methods of construction, tube well design, Conjunctive use	8 hours
Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-5	
Quality of Groundwater and Groundwater Modeling Techniques-Sources of Salinity, Measures of water quality, Chemical analysis, Physical analysis, Chemical Analysis, Groundwater Samples Porous media models, Electric Analog Models ,Digital Computer Models	8 hours

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Teaching-Learning Process	Chalk and Talk, Power point presentation, Testing water quality samples near by Villages

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain the importance of Groundwater
2. Paraphrasing the Characteristics of aquifers
3. Estimate the quantity of groundwater by various methods
4. Analyse the zones of groundwater resource
5. Analyse the quality of groundwater and understand Techniques of modeling

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

Text Books:

1. H.M.Rghunath," Ground waterby ", Wiley Eastern Publishers, New Delhi
2. K.Todd , "Groundwater Hydrology", Wiley Eastern Publishers, New Delhi
3. Bower.H, "Groundwater Hydrolog", McGraw Hill Publishers,New Delhi

Reference Books

1. Garg Satya Prakash, "Groundwater and Tube wells", Oxford and IBH Publication, New Delhi
2. W.C.Walton," Groundwater Resources and Evaluation", Tata Mc Graw Hill Publishers, New Delhi
3. Micheal, D.M., Khepar,.S.D, and Sondhi,S.K, "Water Wells and pumps- ", Mc GrawHill,Delhi Standard Book House, Delhi.

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars
- Pumping test Demonstrations
- Demonstrations of Hydraulic conductivity test in lab
- Video/NPTEL lecture notes

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VI Semester

ALTERNATE BUILDING MATERIALS			
Course Code	21CV646	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Course objectives: This course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Environmental Implications of Buildings

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.BUILDINGS 9 Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Elements of Structural Masonry :

Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, lateriteBlocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar. Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

Alternate Building Materials:

Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.

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Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-4

Alternate Building Technologies:
Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique. **Alternate Roofing Systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-5

Equipment for Production of Alternate Materials:
Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:
Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled**

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down to 50 marks

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers**Reference Books**

Reference books:

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Assignment on alternative building materials used locally for sustainable construction

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VI Semester

Remote Sensing and GIS			
Course Code	**21CV651**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

Course objectives:

- Understand concept of using photographic data to determine relative positions of points.
- Study the methods of collection of land data using Terrestrial and Aerial camera.
- Analyse the data gathered from various sensors and interpret for various applications.
- Apply the principles of RS, GIS and GPS in various scopes of Civil Engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. NPTEL courses on remote sensing and GIS has to be referred to students
2. The online resources for remote sensing data to be made available in the lab
3. Open source software QGIS should be made available in the lab
4. YouTube videos
5. Power point presentations

Module-1

Remote Sensing- Definition, types of remote sensing, components of remote sensing, electromagnetic spectrum, Black body, Atmospheric windows, energy interaction with earth surface features. Spectral reflectance curve. Platforms and sensors. Sensor resolutions. Types of satellites-Indian and other remote sensing satellites (IRS, IKONS and Landsat). Principle of visual interpretation - key elements.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-2

Photogrammetry: Introduction types of Photogrammetry, Advantages Photogrammetry, Introduction to digital Photogrammetry. Aerial Photogrammetry: Advantages over ground survey methods- geometry of vertical photographs, scales of vertical photograph. Ground coordination-relief displacement, scale ground coordinates – flight planning.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-3

Geographic Information System- Introduction, Functions and advantages, sources of data for GIS. Database – Types, advantages and disadvantages. Data Analysis.-overlay operations, network analysis, spatial analysis. Outputs and map generation. GPS- components and working principles.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-4

Applications of GIS, Remote Sensing and GPS: Water Resources engineering and management (prioritization of river basins, water perspective zones and its mapping), Highway and transportation (highway alignment, Optimization of routes, accident analysis), Environmental Engineering

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(Geostatistical analysis of water quality, rainfall).

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Module-5

Applications of GIS, Remote Sensing and GPS: Urban Planning & Management, urban sprawl, Change detection studies, forests and urban area, agriculture, Disaster Management. Layouts: Dead end, Radial, Grid iron, Circular system.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, YouTube videos

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand and remember the principle of Remote Sensing (RS) and Geographical Information Systems (GIS) data acquisition and its applications.
2. Apply RS and GIS technologies in various fields of engineering and social needs
3. Analyse and evaluate the information obtained by applying RS and GIS technologies.
4. Create a feasible solution in the different fields of application of RS and GIS

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
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3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

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5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Geographic Information System-An Introduction, Tor Bernharadsen, 2009, 3rd Edition, Wiley India Pvt. Ltd. New Delhi, ISBN - 9788126511389.
2. Principles of Remote sensing and Image Interpretation, Lillesand and Kiefer, 2011, 6th Edition, John Wiley Publishers, New Delhi, ISBN – 8126532238.
3. Higher Surveying, Chandra A.M, 2015, 3rd Edition, New age international (P) Ltd, ISBN: 8122438121
4. Remote Sensing, Robert A. Schowengerdt, 2009, 3rd Edition, Elsevier India Pvt Ltd, New Delhi.
5. Remote Sensing and GIS, Bhatta B, 2011, Oxford University Press, New Delhi, ISBN - 0198072392

Web links and Video Lectures (e-Resources):

- NPTEL lecture videos

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Delineating the boundary for a watershed using SOI topomap as reference in GIS software
- Delineating the national highway and study the different components
- Delineating different features on land surface and create land use/land cover map using topomap and google earth image of specific region

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VI Semester

TRAFFIC ENGINEERING			
Course Code	21CV652	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Understand fundamental knowledge of traffic engineering, scope and its importance.
- Describe basic techniques for collecting and analyzing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
- Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
- Understand and analyze traffic issues including safety, planning, design, operation and control.
- Apply intelligent transport system and its applications in the present traffic scenario.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident Analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of Service-Concept, applications and significance.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycletracks.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-4

Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

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Module-5

Traffic Management: Area Traffic Management System, Traffic System Management (TSM) withIRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among differentagencies, Intelligent Transport System for traffic management, enforcement and education

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the human factors and vehicular factors in traffic engineering design.
2. Conduct different types of traffic survey sand analysis of collected data using statistical concepts.
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized inter-section analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Kadiyali. L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi,2013
2. S K Khanna and CEG Justo and A. Veeraragavan, "Highway Engineering", Nem Chand and Bros.
3. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan PressLtd.1996.

Reference Books:

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1. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on TrafficPlanning and Management.
2. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineeringand Traffic Analysis, Wiley India Pvt. Ltd., New Delhi,2011.
3. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, NewDelhi,2010.
4. SP: 43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas,1994.
5. John E Tyworth, "Traffic Management Planning, Operations and control", Addison WeslyPublishing Company, 1996.
6. Hobbs.F.D."Traffic Planning and Engineering",University of Brimingham,Peragamon Press Ltd,2005.

Web links and Video Lectures (e-Resources):

- . https://archive.nptel.ac.in/courses/105/105/105105215

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Simple problems solving using Excel
- Discussion of case studies
- Use of software for traffic simulation.

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VI Semester

Occupational Health and Safety			
Course Code	21CV653	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Gain an historical, economic, and organizational perspective of occupational safety and health;
- Investigate current occupational safety and health problems and solutions.
- Identify the forces that influence occupational safety and health.
- Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Encourage collaborative (Group Learning) Learning in the class.
3. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

8 hours

Teaching-Learning Process	Chalk and talk, powerpoint presentation

Module-2

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis , Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations

8 hours

Teaching-Learning Process	. Chalk and talk, powerpoint presentation

Module-3

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety.

8 hours

Teaching-Learning	Chalk and talk, powerpoint presentation

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Process	

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

8 hours

Teaching-Learning Process	Chalk and talk, powerpoint presentation

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

8 hours

Teaching-Learning Process	Chalk and talk, powerpoint presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Goetsch D.L., (1999), "Occupational Safety and Heal th for Technologists, Engineers and Managers", Pren tice Hall.
2. Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Comp any
3. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Poll ution Control Handbook
4. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
5. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

Web links and Video Lectures (e-Resources):

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1. .https://nptel.ac.in/courses/114106017
2. https://youtu.be/8nbOI-0U9Co
3. https://youtu.be/Be9inw8xlw8
4. https://youtu.be/n7oUOUCIblg
5. https://youtu.be/gzgNLvHTrfY
6. https://www.slideshare.net/engkhanmsh/introduction-to-osha-50289682

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- http://nptel.ac.in
- https://swayam.gov.in

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VI Semester

CONSERVATION OF NATURAL RESOURCES			
Course Code	**21CV654**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: Make the students to learn

1. Learn types of land forms, soil conservation and sustainable land use planning.
2. Apprehend water resources, types, distribution, planning and conservation. Water pollution and types of uses.
3. Know the types of minerals and rocks.
4. Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control.
5. Apprehend basics of biodiversity and ecosystems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Power point Presentation
2. Video tube, NPTEL materials
3. Quiz/Assignments/Open book test to develop skills
4. Adopt problem based learning (PBL)to develop analytical and thinking skills
5. Encourage collaborative learning, site visits related to subject and impart practical knowledge
6. Mini projects

Module-1

Land: Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation & PBL

Module-2

Water: Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water, its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation & PBL

Module-3

Air: Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Economic effects of air pollution. Control of air pollution by equipment, smoke and its control. Ozone depletion –impacts, photochemical changes.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation and Model preparation

Module-4

Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry. Ecosystem: Definition, Types: forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of ecosystem.

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation and Field visits.

Module-5

Global warming: concept, indicators, factor and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity. .EIA regulations in India, status of EIA in India, list of projects needing environmental clearance under EIA notifications. Case study of hydro power/ thermal power projects

Teaching-Learning Process	Chalk and talk, PowerPoint Presentation and Mini-projects

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Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Apprehend various components of land as a natural resource and land use planning.
2. Know availability and demand for water resources as applied to India.
3. Analyse the components of air as resource and its pollution.
4. Discuss biodiversity & its role in ecosystem functioning.
5. Critically appreciate the environmental concerns of today.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz/mini project, any one of these suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

1. Modi, P.N., "Irrigation Water Resources and Water Power Engineering". Standard Book House, New Delhi, 10th Edition 2019.
2. Raghunath, H.M., "Groundwater" ,3rd Edition, New Age International Publishers, New Delhi, 2007.
3. Krishnan, M.S., "Geology of India & Burma". CBS publishers, New Delhi, 2017.
4. P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, New Delhi, 2011.
5. M N Rao and H V N Rao, "Air pollution", McGraw Hill Publications 2017.
6. Krishnamurthy K.V., "An advanced textbook of Biodiversity- principle & practices." Oxford and IBH publications Co.Pvt ltd, New Delhi. 2004.

Reference Books :

1. Odum, E.P., "Fundamentals of Ecology", W.B sounders, Philadelphia, USA, 1971
2. Singh J.S, Singh S.P & Gupta, S.R., "Ecology, environment and resource conservation", Anamaya publications, 2006.
3. Edmond A. Mathez & Jason E.Smerdon, "Climate Change: The science of Global warming and our energy feature", Columbia University Press, 2009.
4. National Council of Applied Economic Research, "Economic Impact of Interlinking of Rivers Program", Revised Final Report, April 2008.
6. http://nwda.gov.in/content.
7. Madhav Gadagil, "Biodiversity and Indias degraded lands", Indian Academy of Sciences, Volume 22- No

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2/3, http://www.jstor.org/pss/4314063
Web links and Video Lectures (e-Resources):
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Seminars /Quiz (to assist in GATE preparations) • Demonstrations in lab • Self-Study on simple topics • Simple problems solving by Excel. C+ • Virtual lab experiments

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VII Semester

Quantity Survey and Contract Management			
Course Code:	21CV71	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: To assist students to

- Understand the need for different type of estimate based on project/client specific requirement.
- Understand and interpret the construction drawings and prepare the quantity estimates of building and other common item of works/projects.
- Be able to apply mathematical principles to estimate the earthwork quantities for construction, earthen embankments, canals etc.
- Understand the need for and author the required general, detailed specifications/method statement for various civil engineering activities.
- Generate a justifiable rate for a civil engineering work by analysing various cost involvement.
- Understand, apply and create the tender and contract document

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Chalk & Talk
2. Demonstration using relevant models / drawings
3. Assignment to measure, draw and estimate of an existing civil engineering entity
4. Demonstration of 3-D modelsof Civil Engineering Entities, PPT Presentations
5. Site Visits, Expert Lectures
6. You Tube Channel – Dr A P J Abdul Kalam University, Uttar Pradesh.

Module-1

Estimation: Type of estimates, Understanding the enclosures of an estimate, General terminology, units of measurement, Preparation of abstract, approximate methods of estimating buildings, cost of materials and recommended labour coefficients. Building Estimate: Methods of taking out quantities and cost (center line method & long and short wall method). Preparation of detailed and abstract estimates for– Buildings – Masonry structures, framed structures. flat, slopped RCC roofs with all building components. Culverts (includes box culvert, pipe culvert and RC slab culverts) manhole and septic tank.

Teaching-Learning Process	1. Chalk & Talk 2. Demonstration using relevant models / drawings 3. Demonstration of 3-D modelsof Civil Engineering Entities, PPT Presentations

Module-2

Estimation of flat, slopped RCC roofs, steel truss. Culverts (including box culvert, pipe culvert and RC slab culverts) manhole and septic tank. Measurement of Earth Work for Roads: Methods for computation of earthwork bymid-section formula, trapezoidal or average end area or mean sectional area formula, prismoidal formula.

Project Preparation: Preliminary Survey Report and Detailed Project Report

Teaching-Learning Process	1. Chalk & Talk 2. Demonstration using relevant models / drawings 3. Demonstration of 3-D modelsof Civil Engineering Entities, PPT Presentations

Module-3

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Significance of Microsoft Excel or any other equivalent software in estimation.

Specifications: Definition of specifications, objectives of writing specifications, essentials in specifications, general and detailed specifications of item of works in buildings, specifications of aluminium and wooden partitions, false ceiling, aluminium and fiber doors and windows. Various types of claddings.

Teaching-Learning Process	1. Chalk & Talk 2. Assignment on use of AI & Preparation of a method statement/Open book test

Module-4

Rate analysis: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works or doors, windows and ventilators

Teaching-Learning Process	1. Chalk & Talk 2. Assignment on preparing rate for any specified Civil engineering activity/open book test

Module-5

Contracts: Types of contract-essential of contract –legal aspects, penal provision on breach of contract. Definition of the terms-Tender, Earnest money deposit, tender forms, documents and types. Comparative statements, acceptance of contract documents and issue of work orders, duties and liabilities, termination of contract, completion certificate, quality control, right of contractor refund of deposit. Administrative approval - Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

Teaching-Learning Process	1. Expert Lecture 2. Chalk & Talk, PPT

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Develop the quantity estimates for different Civil Engineering structures, works & also communicate the cost abstract in a simple form to the stake holders.
2. Prepare specifications of various Civil Engineering Structures/works, also will be able to analyse the requirement of a structure /work to arrive at a specific cost for completion of the same.
3. Make use of minimum basic knowledge gained in this course to take up entrepreneurship/employment as a contractor.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi.

Reference Books:

- .Kohli D.D and Kohli R.C, "Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
- Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
- Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
- Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
- Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
- Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi.
- David Pratt, "Fundamentals of Construction Estimating" – 3rd, Edition.
- PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms.

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning •

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
2. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
3. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:

1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behavior"**, Pearson Publications
2. Nether Cot, et.al, **"Behavior and Design of Steel Structures to EC -III"**, CRC Press
3. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
4. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

Web links and Video Lectures (e-Resources):

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VII Semester

ADVANCED DESIGN OF RCC AND STEEL STRUCTURES			
Course Code	21CV721	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to

1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
2. Identify, formulate and solve engineering problems in RC and Steel Structures
3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. .

Module-1

Footings: Design of rectangular slab, slab-beam type combined footing.
Retaining Walls: Design of cantilever Retaining wall. Design concept of counter fort retaining wall.
Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV).**
Portal frames: Design of portal frames with fixed and hinged based supports.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given. (Bolted Connection only)
Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks
Gantry Girder: Design of gantry girder with all necessary checks.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Students will acquire the basic knowledge in design of RCC and Steel Structures.
2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/ Quizz(To assist in GATE Preparations
- Field Visits
- Self Study on simple topics
- Case Study presentations

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- B.S. Ramaswamy "Contracts and their Management" 3rd, Lexis Nexis(a division of Reed Elsevier India Pvt Ltd).

Web links and Video Lectures (e-Resources):

- (166) Quantity Estimation & Construction Management (KCE-503) For AKTU B.TECH - YouTube

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Recording Measurements of an existing building
- Preparing Model of a civil engineering structure
- Validating the material quantity against calculated quantity (ex: validating quantity of concrete prepared against materials calculated as per requirement

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SAMPLE TEMPLATE

VII Semester

CONSTRUCTION TECHNOLOGY FOR SUBSTRUCTURE & SUPERSTRUCTURES

Course Code	21CV72	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+0+0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	2	Exam Hours	03

Course objectives: This course will enable students to:

1. To Understand and appreciate underground construction practices
2. To Understand and appreciate construction of Pile foundations
3. To Understand and appreciate Underwater construction practices

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.
3. Case Study Presentations

Module-1

Underground Construction : Underground– Tunnel-Shaft, Sinking and construction, Micro Tunneling, Tunnel driving in hard and soft strata, bedding of conduits, Soil excavation and Compaction Technology.

Teaching-Learning Process	1. Blackboard teaching/PowerPoint presentations (if needed) 2. Regular review of students by asking questions based on topics covered in the class. 3. Case Study Presentations

Module-2

Under water construction :Problems encountered in excavation, Underwater drilling, blasting, Grouting methods in soft and hard soil including Jet grouting and Chemical grouting, Dewatering in shallow and deep excavations using different methods, Vacuum Dewatering and Well point system.

Teaching-Learning Process	1. Blackboard teaching/PowerPoint presentations (if needed) 2. Regular review of students by asking questions based on topics covered in the class. 3. Case Study Presentations

Module-3

Construction using Concrete Technology: Concrete – Various types and erection methods of shuttering, Operation and erection of Ready Mix Concrete Plant, Pumped Concrete, Concrete mix design with various methods of concreting and also underwater concreting using tremie method, Concreting for under water Construction, Self-compacting concrete.

Teaching-Learning Process	1. Blackboard teaching/PowerPoint presentations (if needed) 2. Regular review of students by asking questions based on topics covered in the class. 3. Case Study Presentations

Module-4

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Pile Construction : Piling – Single pile and a group piles (Bored and Driven) bored piles, Wo r k i n g loads and ultimate loads on driven and cast- in-situ piles, Piles in land and marine structures. Construction details of precast piles, pre stressed piles, steel piles and friction piles. Pile Capacity - Load test on piles initial and routine for vertical, horizontal, uplift loads and integrity test, failure of piles and causes, Methods of pile driving by Vibration and Construction of micro piles, Diaphragm Walls.	
Teaching-Learning Process	1. Blackboard teaching/PowerPoint presentations (if needed) 2. Regular review of students by asking questions based on topics covered in the class. 3. Case Study Presentations
Module-5	
Coffer Dams: Cofferdams – types, design and construction of single, double wall, Cofferdam. Sheet pile cofferdams, concrete wall movable cofferdam, land cofferdams, soldier construction method. Cofferdam wall by ICOS method, coffer dams with touching and interlocking piles and diaphragm wall. **Caissons:** Types, box, pneumatic and open caissons, Well foundations, details, design and Construction of pneumatic and precast caissons.	
Teaching-Learning Process	1. Blackboard teaching/PowerPoint presentations (if needed) 2. Regular review of students by asking questions based on topics covered in the class. 3. Case Study Presentations.

Course outcome (Course Skill Set) After completion of the course, students will be able to,

1. Select Appropriate technology for underground constructions.
2. Able to select appropriate pile construction method and testing of piles.
3. Able to select appropriate concreting practices for different constructions
4. Able to select appropriate underwater construction technology

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Construction Technology: Analysis, and Choice, 2ed,Bryan, Wiley India

2. Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication

3. Construction Equipment Planning and Applications – Dr. Mahesh Varma

4. Brochures Published by various agencies associated with construction.

5. Journals such as CE & CR. Construction world, International Construction. 5. Document Reports of actual major works executed.

6. Construction Technology by Roy Chudley and Roger Greeno, Prentice Hall, 2005.

7. Dr. Kumar Niraj Jha, — Formwork for Concrete Structuresl, Mc Graw Hill Publication9.IS:10262-2016 , "Recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi

Web links and Video Lectures (e-Resources):

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SAMPLE TEMPLATE

VII Semester

ADVANCED GEOTECHNICAL ENGINEERING			
Course Code	21CV722	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to

1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course.
2. Develop profound understanding of shallow and deep foundation analyses.
3. Develop understanding of choice of foundation design parameters.
4. Learn about cause and effect of dynamic loads on foundation.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. .

Module-1

Shallow Foundations: Geotechnical design of Isolated, Combined, Strip, Strap and Raft Foundation Factors influencing the selection of foundation bearing capacity & settlements of raft foundation, Coefficient of sub-grade reaction, Beams on elastic foundation

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-2

Pile Foundations: Necessity of pile foundations, Classification, Load bearing capacity of single pile by Staticformula, Dynamic formula, Pile load test and Penetration tests. Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamedpiles.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-3

Environmental Geotechnical Engineering: Relevance, Subsurface Contamination and Contaminant Transport; Waste disposal on Land and Containment, Monitoring of subsurface contamination, Control and Remediation. Engineering Properties of waste and geotechnical reuse, erosion control, sustainability, energy geotechnics Geotechnical aspects of landfills

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-4

Transportation Geotechnics: Geotechnics of pavements, railway tracks and airfields, Geomaterial includingnon-traditional materials, Asphalt mixtures and hydraulically-bound materials Earthworks for transportation facilities, Construction and maintenance, Performance evaluation and quality control

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-5

Earthquake Geotechnical Engineering: Effect of earthquake on ground, Primary and Secondary effects of earthquake to geotechnical structures, Liquefaction – Mechanism, Consequence, Factors influencing and mitigation against Liquefaction, Site effects, Wave propagation in soils, Case studies of earthquake damage to geotechnical facilities

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Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlementcriteria.
2. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loadedpiles.
3. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons.
4. Understand basics of analysis and design principles of machine foundations.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

Textbooks:

1. Punmia B.C., "Soil Mechanics and Foundation Engineering,Laxmi Publications Co., India.
2. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and FoundationEngineering", CRC Press, New York.
3. Kramer., "Geotechnical Earthquake Engineering", Pearson Education India; 1st edition.
4. Ikuo Towhata., "Geotechnical Earthquake Engineering" Springer; 2008th edition
5. Sarsby, R., Environmental Geotechnics, Thomas Telford, 2000.

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Reference Books:

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India.
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India.
4. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India.
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevantcodes.
6. Dingqing Li, james Hyslip, Ted Sussmann and Steven Chrismer "Railway Geotechnics" CRC Press;1st edition

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

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VII Semester

PAVEMENT MATERIALS AND CONSTRUCTION			
Course Code	21CV723	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Expose students to different materials which are used in pavement construction, impart knowledge about theengineering properties required.
- To train students to perform various types of bituminous mix designs as per the guidelines (MORTH).
- Student will get knowledge about different highway construction equipment with their suitability andadaptability in various field scenarios.
- Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavementas per the required specifications (MORTH).
- To introduce students to possible improvisation in various layers of pavement to increase the structural strengthby the use of non-basic materials (DLC, polythene sheets).

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Pavement Materials

Aggregates- Origin, Classification, Requirements, properties and tests on Road aggregates, Concepts of size andgradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification. **Bituminous Binders-** Origin, Preparation, Properties and Chemical Constitution of bituminous road binders,

Requirements. **Bituminous emulsion and Cutbacks-** Preparation, Characteristics, uses and test. Adhesion of bitumen binders to road aggregates, Adhesion failure, Mechanism of stripping, tests and methods of improving adhesion.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3. Compliment the understanding of Pavement materials with Lab demos / virtual Labs.

Module-2

Bituminous mixes: Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveem stabilometer and Hubbard- field tests) bituminous mixes, Design methods using Rothfutch's method only andspecification, Marshall mix design, volumetric properties, Problems on above.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

Cement and Cement concrete: Material requirement for DLC and PQC, Admixtures, Temp Reinforcement, materials for joints construction, Fibers

Recycled and Alternate Materials – Use of RAP, RCA, Fly ash, Blast furnace Slag, waste plastic, etc. in sustainable pavement construction

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-4

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Equipment in highway construction: Various types of equipment for excavation, grading and compaction-their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement andstabilized soil road construction.
Sub grade: Earthwork grading and Construction of embankments and cuts for roads, Preparation of subgrade, quality control tests

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3. Plan for site visits for students, where pavement construction is going on.

Module-5

Flexible Pavements: Specifications of materials, Construction method and field control checks for various types offlexible pavement layers.
Cement Concrete Pavements: Specifications and method of cement concrete pavement construction (PQC, DLC, White topping, Quality control tests, Construction of various types of joints.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3. Plan for site visits for students, where pavement construction is going on.

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

1. Students will be able to evaluate and assess the suitability of any pavement material to be used in variouscomponents of pavement by conducting required tests as per IS, IRC specifications
2. Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria forvarious mixes as per MORTH and also design bituminous mixes.
3. Students will be competent to adapt suitable modern technique and equipment for speedy and economicconstruction.
4. Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:
Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**
(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:
Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

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1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Highway Engineering- Khanna, S.K., and Justo, C.E.G.: Nem Chand and Bros. Roorkee.
2. Construction Equipment and its Management- Sharma, S.C.:Khanna Publishers.
3. Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhai, P.S: University ofTexas Austin, Texas. NAPA Education Foundation Lanham, Marylan.
4. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
5. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
6. Relevant IRC codes and MoRT& H specifications

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU EDUSAT PROGRAMME – 20

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Demonstrations in Lab
- Self-Study on simple topics
- Simple problems solving using Excel
- Discussion of case studies
- Field visits to construction sites

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VII Semester

SOLID WASTE MANAGEMENT			
Course Code	21CV724	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3hours

Course objectives:

- To provide detailed knowledge and skills in the management, treatment, disposal and recycling options for solid wastes, while focusing on key engineering and technical aspects involved. Understanding of the basic principles of waste and resource management will be supplemented, where appropriate, by practical problem-solving exercises in the context of civil engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills .
2. Arrange visits to nearby solid waste disposal sites
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1

Introduction : Functional elements of municipal solid waste (MSW) management system, Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems. Environmental implications of open dumping of MSW, Construction debris – management & handling. Rag pickers and their role.Solid waste management 2000 rules with 2016 amendments.

10hours

Teaching-Learning Process	Chalk and talk, Powerpoint presentation

Module-2

Collection: Collection of solid waste- services and systems Haul and stationary container system-numericals, equipments, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization.

8 hours

Teaching-Learning Process	. Site visit, Powerpoint presentation, Activity based learning

Module-3

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TREATMENT / PROCESSING TECHNIQUES: Components separation,volume reduction, size reduction, chemical reduction and biological processing problems.
COMPOSTING: Aerobic and anaerobic composting, factors affectingcomposting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermicomposting.

8 Hours

Teaching-Learning Process	Powerpoint presentation, Site visit, videos,

Module-4

SANITARY LAND FILLING: Different types, trench area, Ramp and pitmethod, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetic fabrics in sanitary land fills.

INCINERATION: Process – 3 T's, factors affecting incineration process,incinerators – types, prevention of air pollution, pyrolsis, design criteria for incineration.

8 Hours

Teaching-Learning Process	Chalk and talk, Powerpoint presentation, site visit

Module-5

Sources, collection, treatment and disposal:- Biomedical waste and E-waste,

RECYCLE AND REUSE: Material and energy recovery operations, reusein other industries, plastic wastes, environmental significance and reuse.

10 hours

Teaching-Learning Process	Chalk and talk, Powerpoint presentation, videos

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. CO1: Identify improper practices of solid waste disposal and their environmental implications. Know the basic engineering principles of solid waste management
2. CO2: Describe the need for economics in collection and transportation of solid waste and clearly discuss various types of collection systems and analyse system dynamics
3. CO3: Understand the management concepts, define 4 R approach, apply PPP model and community involvement for effective management of solid waste
4. CO4: Develop a concise idea on various conventional and advanced treatment options for solid waste
5. CO5: Conceive the design aspects of engineered disposal options and apply the gained knowledge

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Tchobanoglous G., Theissen H., and Eliassen R., "Solid Waste Engineering Principles and Management Issues", McGraw Hill, New York. Pavoni J.L., "Handbook of Solid Waste Disposal".
2. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw Hill.
3. Mantell C.L., (1975), "Solid Waste Management", John Wiley
4.

Web links and Video Lectures (e-Resources):

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.Course URL: https://swayam.gov.in/nd1_noc20_ce56/... Prof. Ajay Kalamdhad Civil Engineering IIT Guwahati

- Introduction to solid waste
  https://www.youtube.com/watch?v=k0ktJRoRcOA
- Solid waste management
  https://www.youtube.com/watch?v=sMcUGwpvLtk
- Municipal Solid Waste Management (Civil Engineering)
  https://www.digimat.in/nptel/courses/video/105103205/L01.html
- Primary collection SWM
  https://www.digimat.in/nptel/courses/video/105103205/L09.html
- Solid waste types, methods, challenges and solutions
  https://www.youtube.com/watch?v=T_pIJiZ8JYI
- Types and sources of SWM
  https://www.digimat.in/nptel/courses/video/105103205/L03.html

- Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
  http://nptel.ac.in
- https://swayam.gov.in
- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

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VII Semester

Design of Hydraulic Structures			
Course Code	21CV725	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: Make the students to:

- Analyse and design gravity dam
- Design earth dam and estimate the seepage loss
- Design spillway and apron fror diversion works
- Design CD works and can regulation works

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Power point Presentation, video
2. Video tube, NPTEL materials
3. Quiz/Assignments/Open book test to develop skills
4. Adopt problem based learning (PBL)to develop analytical and thinking skills
5. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

Module-1

Gravity Dam: Introduction, forces acting on dam section, causes of failure, design principles, Principal and Shear stresses, Elementary and practical profile of gravity dam, Drainage gallaries.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation

Module-2

Earth Dam: Introduction, Causes of failure, Design criteria, Preliminary section, Determination of phreatic line, Estimation of seepage loss.	8 hours
Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, Analysis in Laboratory

Module-3

Spillway: Types, Design of Ogee spillway, Upstream and Downstream profile, Energy dissipation below spillway. Diversion Headwork: Design of weir on permeable soil, Design of impervious foundation using Bligh's and Khosla's theory, Simple problems on floor design.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs

Module-4

Cross Drainage Works: Introduction, Types, Design considerations, Transition formula, Design of Aqueduct.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs

Module-5

Canal Regulation Works: Introduction, Functions of Head and Cross regulations, Longitudinal section and their component parts. Canal Falls: Necessity and features of various canal types Canal outlets: Necessity and types.	8 hours

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Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs and visit to power station as part of industrial visit

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Design the gravity dam section and also check its stability.
- Do preliminary design of earth dam and estimate seepage loss
- Design spillway profile and floor of weir on permeable foundation.
- Identify type of regulator for a can system/network

Suggested Learning Resources:

Text Books:

1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
2. Punmia and Lal Pandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3. K. R. Arora, " Irrigation, Water Power and Water Resources Engineering", Standard Publishers, New Delhi

Reference Books:

1. Sharma R.K., "Text Book of Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
2. Modi P.N., "Irrigation, Water Resources and Water Power Engineering"- Standard book house, Delhi.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars /Quiz (to assist in GATE preparations)
- Demonstrations in lab
- Self-Study on simple topics
- Simple problems solving by C+
- Virtual lab experiments

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VII Semester

REPAIR, RETROFITTING AND REHABILITATION OF STRUCTURES			
Course Code	21CV726	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to;

1. Investigate the cause of deterioration of concrete structures.
2. Strategies different repair and rehabilitation of structures.
3. Evaluate the performance of the materials for repair

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. .

Module-1

General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-2

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-3

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-4

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Module-5

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Materials for Repair and Retrofitting: Artificial fiber reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Identify the causes for structural (Concrete) deterioration.
2. Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.
3. Recommend maintenance requirements of the buildings and preventive measures against influencing factors.
4. Select suitable material and suggest an appropriate method for repair and rehabilitation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and

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Repair"- Longman Scientific and Technical.

Reference Books:

1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).
3. CPWD Manual

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

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VII Semester

EARTHQUAKE ENGINEERING			
Course Code	21CV731	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

1. Understand the philosophy of Earthquake Resistant Design,
2. Learn behavior of structure during earthquake
3. Understand the concept of Seismic-resistant building architecture
4. Apply the concept of ductile detailing in RC structures.
5. Analyse and earthquake resistant design of multi story RCC building

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. .

Module-1

Design philosophy: Philosophy of earthquake resistant design, earthquake proof v/s earthquake resistant design, four virtues of earthquake resistant structures(strength, stiffness, ductility and configuration), seismic structural configuration, Introduction to IS: 1893 (Part I), IS: 875 (Part V), and IS code provisions

Teaching-Learning Process	

Module-2

Behavior of Structures During Earthquake and Earthquake Resistant Features of Structure: Inertia forces in structures, Behavior of Brick and stone Masonry Structures: Behavior of Brick and stone Masonry Walls, Box Action, Different types of Bands, Earthquake Resistant Features of Stone Masonry Structures. Behavior of RC Structures: Load Transfer Path, Strength Hierarchy, Reversal of Stresses, Importance of Beam Column Joints, Importance of Stiffness and Ductility (Capacity Design Concept) in Structures, Effect of Short Column, Effect of Soft Storey, Improper Detailing, Effect of Masonry Infill Walls, Effect of Eccentricity

Teaching-Learning Process	.

Module-3

Seismic-resistant building architecture: Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity /redundancy, non-structural elements.

Teaching-Learning Process	

Module-4

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Ductility considerations in earthquake resistant design of RCC buildings: Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility–Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920	
Teaching-Learning Process	
Module-5	
Earthquake resistant design of a multi-storey RCC building: Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893(Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member ,typical column, footing and detailing of a exterior joint as per IS13920	
Teaching-Learning Process	

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Apply the concept of earthquake engineering in seismic analysis and design of structures

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Earthquake resistance design of structure by Duggal- Oxford University Press.
2. Earthquake – Resistant Design of Building Structures-Dr. Vinod Hosur-- Wiley India
3. Earthquake resistant design of structures- Agarwal, Shrikhande, PHI learning. Reference
4. Dynamics of structure by Clough R.W. and Penzin J. McGraw Hill Civil Engineering Series.
5. Dynamics of structure by Anil Chopra, Prentice Hall India Publication.
6. Dynamics of structure by Mario Paz, CBSPD Publication

Web links and Video Lectures (e-Resources):

- 1. www.nicee.org
- 2. www.eeri.org
- 3. www.gsdma.org
- 4. www.ndma.gov.in
- 5. www.nptel.iitm.ac.in/courses/
- 6. www.nisee.berkeley.edu/elibrary/getpkg?id=NONLIN

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- 1: Design philosophy of earthquake resistant design.
- 2: Behavior of Brick and stone Masonry Structures.
- 3: Seismic-resistant building architecture.
- 4: Assessment of ductility of Member/element ductility and Structural ductility.
- 5: Determination of lateral forces on an intermediate plane frame using equivalent static

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SAMPLE TEMPLATE

VII Semester

GROUND IMPROVEMENT TECHNIQUES			
Course Code	21CV732	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

Thiscoursewillenablestudentsto

1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, science and geotechnical engineering to solve problems in the field of modification of ground required for construction of civilengineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosyntheti cs, vibration,grouting and injection.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. .

Module-1

Mechanical Stabilization: Relative Compaction, Field Compaction Control, Shallow and Deep Compaction, Sand Compaction pile, Vibrofloatation, Dynamic Compaction, Stone Column. Field compaction control- compactive effort & methods of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipment and their suitability.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-2

Chemical Stabilization

Cement, Lime, Flyash and Other Chemicals treatments-Mechanism, Suitability and factors influencing Chemical Stabilization (e.g:Terrazyme, Lignin etc). Field stabilization procedures and case studies.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-3

Hydraulic Stabilization: Dewatering, Electro-osmosis, Band drains, vertical drains, and Preloading. Electrokinetic dewatering, Other Methods of dewatering, seepage control, filter requirements.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-4

Reinforced earth: Concept, Components, Technique, advantages and disadvantages and applications

Soil Nailing: Importance, procedure, advantages and disadvantages

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-5

Geosynthetics:Types of geosynthetics, Mechanical and hydraulic properties, durability, applications of geosynthetics, Gabions and Mattresses, Anchors, Rock bolts, Micro piles

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

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Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. Utilize properly the locally available materials and techniques for ground improvement so thateconomy in the design of foundations of various civil engineering structures

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

Textbooks:

1. PurushothamaRajP,"GroundImprovementTechniques",LaxmiPublications,NewDelhi.
2. KoernerR.M,"ConstructionandGeotechnicalMethodinFoundationEngineering",McGrawHillPub.C
3. G L Shivakumarbabu, An Introduction to Soil Reinforcement and Geosynthetics, UniversitiesPress (India) Pvt. Ltd

Reference Books:

1. Bell,F.G.,"Methodsoftreatmentofunstableground",Butterworths,London.
2. NelsonJ.D.andMillerD.J,"Expansivesoils",JohnWileyandSons.
3. Ingles.C.G.andMetcalfJ.B,"SoilStabilization:PrinciplesandPractice",Butterworths
4. ManfredHausmann,"Engineeringprinciplesofgroundmodification",McGrawHillPub.Co.,

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning •

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VII Semester

PAVEMENT DESIGN			
Course Code	21CV733	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Gain knowledge about the process of collecting data required for design, factors affecting pavement design,and maintenance of pavement.
- Excel in the path of analysis of stress, strain and deflection in pavement.
- Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
- Understand the various causes leading to failure of pavement and remedies for the same.
- Develop skills to perform functional and structural evaluation of pavement by suitable methods.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course,surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, 2012 problems on above.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3.To make students understand the basic concepts of design methodology as per IRC 37.

Module-3

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkelman beam deflection method, Falling weight deflectometer, GPR method. Designfactors for runway pavements, Design methods for Airfield pavement and problems on above.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3. Conduct field studies and demos.

Module-4

Stresses in Rigid Pavement: Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses(using chart / equations), problems on above.

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements,

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Design methods for airfield pavements, problems of the above	
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.
Module-5	
Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement,Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.	
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 3. Conduct field studies and demos.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Systematically generate and compile required data for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on sitespecific requirements

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

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Suggested Learning Resources:

Books

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R Kadiyali and Dr.N.B. Lal, "Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang, "Pavement Analysis and Design", University of Kentucky
4. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
5. Subbarao's, "Principles of Pavement Design".
6. R Srinivasa Kumar, "Pavement Design", University Press.
7. Relevant recent IRC codes

Web links and Video Lectures (e-Resources):

- . https://nptel.ac.in/courses/105104098

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Simple problems solving using Excel
- Guided practice to use IITPave for Pavement Design
- Discussion of case studies & Data collection methods for pavement design

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VII Semester

Air Pollution and Control			
Course Code	21CV734	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

. Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills
2. Encourage collaborative (Group Learning) Learning in the class.
3. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
5. Take the students to visit any industries to show the air pollution control equipments.

Module-1

Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation

Module-2

Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths

Teaching-Learning Process	. Chalk and talk, videos, PowerPoint Presentation, animations

Module-3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants ($PM_{2.5}$, PM_{10}, SO_X, NO_X, CO, NH_3). Development of air quality models-Gaussian dispersion model-Including Numerical problems.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations

Module-4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP - Including Numerical problems. Site selection for industrial plant location.

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Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations

Module-5

Air pollution due to automobiles, standards and control methods. Noise pollution- causes, effects and control, noise standards. Environmental issues, global episodes. Environmental laws and acts.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication.
2. H. C. Perkins, "Air pollution". Tata McGraw Hill Publication.

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3. Mackenzie Davis and David Cornwell, "Introduction t o Environmental Engineering" McGraw-Hill Co.

Web links and Video Lectures (e-Resources):

https://www.digimat.in/nptel/courses/video/105104099/L01.html
https://www.digimat.in/nptel/courses/video/105104099/L02.html
https://www.digimat.in/nptel/courses/video/105104099/L03.html

- Activity Based Learning (Suggested Activities in Class)/ Practical Based learning http://nptel.ac.in
- https://swayam.gov.in
- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

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VII Semester

Open Channel Hydraulics			
Course Code	21CV735	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: Make the students to learn

1. To know different classification of flows in open channel
2. Concept o energy for channel design
3. Characteristics of GVF and RVF
4. Characteristics of flow profiles
5. To study different possible energy dissipaters

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Power point Presentation, video
2. Video tube, NPTEL materials
3. Quiz/Assignments/Open book test to develop skills
4. Adopt problem based learning (PBL)to develop analytical and thinking skills
5. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

Module-1

Difference between pipe flow and open channel flow, classification of flow, energy equation, momentum equation, kinetic energy and momentum factors. Concepts, uniform flow equations, conveyance and hydraulic exponent for uniform flow, design of channels for uniform flow.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation

Module-2

Concept of specific Energy – Classification of flow. Design of channel, Section Factor, Hydraulic exponent for critical flow critical depth as a flow measurement.	8 hours
Teaching-Learning Process	Chalk and talk, PowerPoint Presentation, Analysis in Laboratory

Module-3

Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation, Characteristics of flow profile and classification. Analysis of flows profiles, Method of singular point and transitional depth, Methods of computation, Practical problems.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs

Module-4

Gradually Varied Flow Computations: Different methods, direct integration method, Bress's Solution, Chow's solution, direct method, standard step method.	8 hours
Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs

Module-5

Rapidly Varied Flow: Concepts, hydraulic jump in rectangular channels, classification of jumps, characteristics of jump – length location height, application of hydraulic jump stilling basins, shape type-2 and type-4. Hydraulic jump in rectangular channels, Sloping channels, Jump in non rectangular channels, application of hydraulic jump as energy dissipaters.	8 hours

Teaching-Learning Process	Chalk and talk, Power Point Presentation and demonstration in labs and visit to power station as part of industrial visit

Course outcome (Course Skill Set): At the end of the program, the students will be able to:

- Identify flow type in open channel
- Apply concept of energy for channel design
- Compute GVF and RVF profiles for the flow
- Design energy dissipaters for the flow conditions

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books:

1. Flow through open channel by K. G. Rangaraju, ISBN: 007096565X, 9780070965652, Tata McGraw-Hill, 2001
2. Flow in open channels by K Subramanya, 5th Edition, Tata McGraw-Hill, 2019
3. Open Channel Hydraulics by Ven Te Chow, The Blackburn Press, ISBN-10: 1932846182, ISBN-13: 978-1932846188
4. Open-Channel Flow, Subhash C. Jain, ISBN: 978-0-471-35641-7 October 2000,Wiley Publication
5. Open Channel Hydraulics, 3rd Edition, Terry W. Sturm, ISBN: 9781260469707, 2021

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SAMPLE TEMPLATE

VII Semester

MASONRY STRUCTURES			
Course Code	21CV736	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. .

Module-1

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials–classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-2

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Design Considerations: Effective height of wall sand columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-3

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.
Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads –Problems onec centrically loaded solid walls, cavity walls, walls with piers.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Module-5

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.
Introduction to reinforced brick masonry, lintels and slabs.
In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Select suitable material for masonry construction by understanding engineering properties.
2. Compute loads, load combinations and analyze the stresses in masonry.
3. Design masonry under compression (Axial load) for various requirements and conditions.
4. Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions.
5. Assess the behavior of shear wall and reinforced masonry.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Dayaratnam P, "Brick and Reinforced Brick Structures", Scientific International Pvt. Ltd.
2. M. L. Gambhir, "Building and Construction Materials", McGraw Hill education Pvt. Ltd.

Reference Books:

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd.,1990.
2. IS 1905–1987 "Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi.
3. SP20(S&T)–1991,"Hand book on masonry design and construction(1st revision) BIS, New Delhi.

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
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VII Semester

FINITE ELEMENT METHOD			
Course Code	21CV741	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:

1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. .

Module-1

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos.

Module-2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos.

Module-3

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisym metric Element.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos.

Module-4

Isopara metric concepts; is opera metric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isopara metric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos.

Module-5

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.

Structure of computer program for FEM analysis, description of different modules, exposure to FEM

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softwares.	
Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos.

Course outcome (Course Skill Set)

The student will have the knowledge on advanced methods of analysis of structures.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al. "Concepts and applications of Finite Element analysis", John Wiley.

Reference Books:

1. Daryl L Logan, "A first course on Finite element Method", Cengage Learning.
2. Bathe K J - "Finite Element Procedures in Engineering analysis"- Prentice Hall.

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Web links and Video Lectures (e-Resources):
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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
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VII Semester

NUMERICAL METHODS AND APPLICATIONS			
Course Code	**21CV742**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- 1. To introduce numerical methods to solve different types of equations.
- 2. To introduce regression and interpolation techniques.
- 3. To know various methods of Differentiation & Integration.
- 4. To apply the knowledge of these methods to solve practical problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Some lecture material is delivered using online screen casts together with interactive exercises and quizzes. Other lecture material is delivered in traditional face-to-face lecture format.

Module-1

a) Errors: Introduction, Types of errors, Rules for estimate errors, Error propagation, Error in the approximation of function.

b)Roots of Equation: Bracketing Method: Bisection Method, False position method . Open method: Newton-Raphson's method for Single root, multiple root, Iterative method for Non-linear equations. Roots of polynomial: Muller's Method, limited to TWO Iterations. Initial guesses not to be given.

Teaching-Learning Process	

Module-2

Linear Algebraic Equation:

a. Gauss Elimination Method. Pitfalls and improving techniques.

b. LU decomposition method, Gauss-Jacobi and Gauss-Seidel Iteration method

Teaching-Learning Process	.

Module-3

Curve Fitting & Interpolation:

a. Least Square Regression – Linear regression, Parabolic regression

b. Interpolation–Interpolating polynomial, Lagrange's interpolating polynomial, Divided Difference Formula

Teaching-Learning Process	

Module-4

Numerical Differentiation and Integration

a. Newton-Cote's Integration of equation: Trapezoidal rule, Simpson's rules. Integration of Equation: Gauss Quadrature methods.

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b. Numerical differentiation: For Equally spaced Data: Forward difference Formula, Central difference Formula, Backward difference Formula. For unequally spaced Data: Divided difference Formula.	
Teaching-Learning Process	
Module-5	
Ordinary Differential Equation: a. Taylor's series method, Picard's Method, Euler's Method, Runge-Kutta 4th Order method b. Boundary value Problem: Finite Difference Method . Eigen value problem: Eigen value problem based on Power method	
Teaching-Learning Process	

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand and apply various methods to find roots of equations.
2. Learn and Implement different methods to solve simultaneous equations.
3. Understand and apply the methods of Regression and interpolation.
4. Implement various numerical methods for differentiation and Integration.
5. Apply various methods to solve engineering problems with Ordinary differential equations.

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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Higher Engineering Mathematics", Dr. B. S. Grewal, Khanna Publishers, New Delhi, 7th Edition, 2005.
2. "Numerical Methods", Dr. B.S. Grewal, Khanna Publishers, New Delhi, 7th Edition, 2005.
3. "Numerical Methods", E Balguruswamy Tata McGraw-Hill Publication Company Ltd. 8th Edition, 2002.
4. "Numerical Methods", S. Arumugam, A. Thangapandi Isaac and A.Somasundaram, SciTech Publications India Pvt. Ltd. Chennai, 2nd Edition, 2007.
5. "Numerical Methods", Dr. P. Kandasamy, Dr. K. Gunavathi, Dr. K. Thilagavathy. S Chand Publication, New Delhi, 2nd Edition, 2006
6. "Numerical Methods", G. Haribaskaran, Laxmi Publications Pvt. Ltd, New Delhi, 1st Edition, 2006.

Web links and Video Lectures (e-Resources):

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- https://nptel.ac.in/courses/111107105
- https://www.coursera.org/learn/numerical-methods-engineers
- https://cosmolearning.org/courses/numerical-methods-and-programing/video-lectures/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At least one problem should be solved based on each method from every module

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VII Semester

Environmental Protection and Management			
Course Code	21CV743	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- This course will enable students to gain knowledge in Environmental protection and Management systems

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills .
2. Encourage collaborative (Group Learning) Learning in the class.
3. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1

Environmental Management Standards: Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

8 hours

Teaching-Learning Process	Chalk and talk, powerpoint presentation

Module-2

Environmental Management Objectives: Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies

8 hours

Teaching-Learning Process	. Chalk and talk, powerpoint presentation

Module-3

Environmental Management SystemEMAS: ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and

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document control – operational control – monitoring and measurement – management review. 8 hours	
Teaching-Learning Process	Chalk and talk, powerpoint presentation
Module-4	
Environmental Audit: Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit 8 hours	
Teaching-Learning Process	Chalk and talk, powerpoint presentation
Module-5	
Applications of EMS : Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, , Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes. 8 hours	
Teaching-Learning Process	Chalk and talk, powerpoint presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards
2. Lead pollution prevention assessment team and implement waste minimization options
3. Develop, Implement, maintain and Audit Environmental Management systems for Organisations

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Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
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Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.

2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004

3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002

4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice , McGraw- Hill International, Boston,2000.

5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

Web links and Video Lectures (e-Resources):

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1. .https://youtu.be/fj79O9RSvcA
2. https://youtu.be/XGYbvl0xqmw
3. https://youtu.be/ID_gk0aSo0Y
4. https://nptel.ac.in/courses/120108004
5. https://www.slideshare.net/RajendraGhuge/environmentmanagemnent-notes

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- http://nptel.ac.in
- https://swayam.gov.in

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VII Semester

INTELLIGENT TRANSPORTATION SYSTEMS			
Course Code	21CV744	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

This course will enable students to

- Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control.
- Learn how Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic, inform travellers and drivers, operate public transport, automating payments, handle emergencies and incidents, operate commercial fleets and freight exchange, and automate driving and safety.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI),Geographic Information Systems (GIS), video data collection

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-2

Advanced traveler information systems; transportation network operations; commercial vehicle operations and intermodal freight.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-3

Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-4

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS and sustainable mobility.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

Module-5

Travel demand management, electronic toll collection, and ITS and road-pricing. Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS Implementations in developed countries, ITS in developing countries.

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

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Course outcome (Course Skill Set)

After studying this course, students would be able to suggest the appropriate system/s in various functional areas of transportation. Would be able to amalgamate the various systems, plan and implement the applications of ITS. Would have learnt the application of information technology and telecommunication to control traffic and also provide advance information to the travellers, automatic handling of emergencies and to improve safety.

Graduate Attributes (as per NBA)

- *Scholarship of Knowledge.*
- *Critical thinking.*
- *Ethical practices and social responsibility*
- *Use of modern tools*

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The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation SystemsPlanning" Artech House.
2. Pradip Kumar Sarkar, Amit Kumar Jain, "Intelligent Transport Systems", PHI LearningPublishers
3. Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)"ITS Hand Book 2000.
4. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005.
5. US Department of Transportation, "National ITS Architecture Documentation", 2007(CDROM).

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6. Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems"

Web links and Video Lectures (e-Resources):

- . https://nptel.ac.in/courses/105107210
- https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Simple problems solving using Excel
- Discussion of case studies
- Virtual Lab experiments

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