NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous College under VTU)

NAAC Accredited with 'A+' Grade

Bachelor of Engineering

Department of Civil Engineering

III to VIII SEMESTER (Scheme)
III to VII SEMESTER (Syllabus)

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

Outcome

Based Education 2021-2022

Department of Civil Engineering

Nagarjuna College of Engineering & Technology

Mudugurki Village, Venkatagiri Kote Post, Devanahalli Taluk,
Bangalore District-562164

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF CIVIL ENGINEERING

VISION

To transform the students as leaders in Civil Engineering to achieve professional excellence in thechallenging future

MISSION

M1: To provide the Civil Engineering knowledge and skills for students through an excellent academicenvironment.

M2: Adopting innovative teaching techniques using modern engineering tools for designing, modelingand analyzing the societal and environmental problems.

M3: Developing Communication skill, leadership qualities through team work and skills for continuingeducation among the students.

M4: To inculcate moral, ethical and professional values among students to serve the society.

M5: Validate engineering knowledge through innovative research projects to enhance theiremployability and entrepreneurship skills.

Program Educational Objectives (PEOs)

- **PEO1**: Graduates in Civil Engineering will apply the technical knowledge for sustainable societal growth.
- **PEO2**: Graduates of civil Engineering will demonstrate designing, modeling and analyzing skills.
- **PEO3**: Graduates in Civil Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.
- **PEO4**: Civil Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.
- **PEO5**: Civil engineering graduates will have the ability to become entrepreneurs thereby switching over from responsive engineering to creative engineering.

Program Outcomes (Pos)

- **PO-1**: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and Civil Engineering principles to the solution of complex problems in Civil Engineering.
- **PO-2**: Problem Analysis: Identify, formulate, research literature and analyze complex Civil Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.
- **PO-3**: Design/Development of Solutions: Design solutions for complex Civil Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.
- **PO-4**: Conduct Investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions related to Civil Engineering problems.
- **PO-5**: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering tools such as CAD, FEM, GIS, etc. including prediction and modeling to complex Civil Engineering activities with an understanding of the limitations.

- **PO-6**: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Civil Engineering practice.
- **PO-7**: Environment and Sustainability: Understand the impact of the professional Civil Engineering solutions in societal and environmental contexts and demonstrate the knowledge and the need for sustainable development.
- **PO-8**: Ethics: Apply ethical principles and commit to professional ethics and responsibilities while following the Civil Engineering practice.
- **PO-9**: Individual and Team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
- **PO-10**: Communication: Communicate effectively on complex Civil Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO-11**: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Civil Engineering projects and in multidisciplinary environments.
- **PO-12**: Life Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO)

- **PSO-1:** Apply the knowledge of Civil Engineering in Sustainable Infrastructure developments.
- **PSO-2:** Identify, analyze and manage Civil Engineering problems with ethical and social responsibilities.
- **PSO-3:** Implementation of relevant codes/ specifications/ guidelines to arrive at comprehensive solutions to address societal needs and exhibit communication and teamwork skills.

Scheme & Syllabus
With effect from
Academic Year 2021-22

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY, BENGALURU

B.E. in Civil Engineering

Scheme of Teaching and Examination 2022-2023

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS), Effective from the academic year 2022-2023

III SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week				Duration in Hours	Examination			Credits
					Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	BSC	21MAT31	Transform Calculus, Fourier Series and Numerical Technique	Maths	2	2	-	-	03	50	50	100	3
2.	PCC	21CVT32	Strength of Materials	CV	2	2	-	-	03	50	50	100	3
3.	IPCC	21CVI33	Construction Materials and Technology (IC)	CV	2	2	2	-	03	50	50	100	4
4.	IPCC	21CVI34	Geodetic Engineering (IC)	CV	2	2	2	-	03	50	50	100	4
5.	PCCL	21CVL35	Building Planning and Drawing Lab–I	CV	-	-	2	-	03	50	50	100	1
6.	UHV	21UHV36	Social Connect & Responsibility	Any Dept	1	-	-	-	03	50	50	100	1
7.	HSMC	21CPC37	Constitution of India, Professional Ethics and Cyber Law	CV	1	-	-	-	03	50	50	100	1
8.	AEC	21AEC38A	Building Services	CV	1	-	-	-	03	50	50	100	1
9	PET	21CPH39	Employability Skill - I	PET									0
10	NMDC	21NS39	National Service Scheme (NSS)	Any Dept	-	-	2	-		100		100	0
		21PE39	Physical Education (PE) (Sports and Athletics)										
		21YO39	Yoga										
	BSC	NCMC21MATDIP31	Additional Mathematics										
				TOTAL									18

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B.E. in Civil Engineering

Scheme of Teaching and Examination 2021-22

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS),Effective from the academic year 2022-23

IV SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week				Duration in Hours	Examination			Credits
					Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT41	Complex Analysis , Probability and Statistical Inference	Maths	2	2	-	-	3	50	50	100	3
2	PCC	21CVT42	Structural Analysis	CV	2	2	-	-	3	50	50	100	3
3	IPCC	21CVI43	Public Health Engineering (IC)	CV	2	2	2	--	3	50	50	100	4
4	IPCC	21CVI44	Fluids Mechanics and Machinery (IC)	CV	2	2	2	-	3	50	50	100	4
5	PCC	21CVL45	Building Construction and PlanningLab	CV	2	-	-	-	3	50	50	100	1
6	INT	21CVI46	Internship -1	CV			4		3	100	00	100	2
7	HSMC	21KSK47	Samskrutika Kannada	HSMC	-	2	-	-	1	50	50	100	1
		21KBK47	Balake Kannada										
8	AEC1	21AEC49A	Earth Science in Engineering	BSC	2		2	-	2	50	50	100	3
9	UHV	21UHV49B	Universal Human Value	HSMC	-	-	-	2	1	50	50	100	1
				TOTAL						550	450	1000	22

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B.E. in Civil Engineering

Scheme of Teaching and Examination 2021-22

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS), (Effective from the academic year 2022-23)

V SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week				Duration in Hours	Examination			Credits
					Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	21CVT51	DESIGN OF REINFORCED CONCRETE STRUCTURES	CV	3	-	-	-	3	50	50	100	3
2	PCC	21CVT52	Geo Technical Engineering	CV	3				3	50	50	100	3
3	IPCC	21CVI53	Transportation Engineering (IC)	CV	2	2	2		3	50	50	100	4
4	PCCL	21CVL54	Concrete Technology Laboratory	CV			2		3	50	50	100	1
5	PCC	21CVT554	**Professional Elective –I,** 1. Alternate building materials 2. Analysis of Indeterminate structures 3. Air pollution controlling and Monitoring **4. Geographic Information SIS & Practice**	CV	3				3	50	50	100	3
6	UHV	21ENV56	Environmental Studies	CV	1				3	50	50	100	1
7	AEC1	21AEC57	Application of AI in Civil Engineering	CV	2				2	50	50	100	2
8	AEC2	21AEC58	Quality Control & Quality Assurance	CV	1				2	50	50	100	1
				TOTAL						400	400	800	18

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Scheme of Teaching and Examination 2021-22

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS), (Effective from the academic year 2022-23)

VI SEMESTER

Sl. No.	Course and Course Code		Course Title	Faculty Allotted for framing the syllabus	Teaching Department	Teaching Hours / Week				Duration in Hours	Examination			Credits
						Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	Total Marks	
						L	T	P	S					
1	PCC	21CVT61	Construction Management & Entrepreneurship		CV	3	-	-	-	3	50	50	100	3
2	PCC	21CVT62	Geo Technical Engineering - II		CV	3	-	-	-	3	50	50	100	3
3	IPCC	21CVI63	Design & drawing of Steel Structures		CV	2	2	2		3	50	50	100	4
4	PEC	21CVT64X	Professional Elective Hydraulic Structures Bridge Engineering Ground Water Hydrology Remote Sensing		CV	3	-	-	-	3	50	50	100	3
5	PCCL	21CVL65	Geo Technical Laboratory		CV	-	-	2	-	3	50	50	100	1
6	MEP	21CVT66X	Open Elective, Intelligent Transport System Environmental Protection & Management Energy Efficiency in green Buildings Railways and airport Engineering		CV	3	-	-	-	3	50	50	100	3
7	MP	21CVT67	Mini Project		CV	1	-	-	2	3	50	50	100	2
8	INT	21CVT68	Internship		CV	-	-	3	3	-	50	50	100	3
	TOTAL										400	400	800	22

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Scheme of Teaching and Examination 2021-22

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS), (Effective from the academic year 2022-23)

VII SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Duration in Hours	Examination			Credits
					Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	CIE Marks	
					L	T	P	S					
1	PCC	21CVT71	Estimation, Costing and Valuation	CV	2	2	-	-	3	50	50	100	3
2	PCC	21CVT72	Prestressed Concrete	CV	2	1	-	-	3	50	50	100	2
3	PEC	21CVP73X	Professional Elective Course-II, Advanced Foundation Engineering Traffic Engineering & Management Occupational Health & Safety	CV	3	-	-	-	3	50	50	100	3
4	PEC	21CVP74X	Professional Elective Course-III Solid Waste Management Construction Planning & Project Management Natural Disaster Mitigation & Management.	CV	3	-	-	-	3	50	50	100	3
5	MEP	21XXX75X	Open elective Course-III Remote Sensing & GIS Municipal Waste Water Treatment Environmental Impact Analysis	CV	3	-	-	-	3	50	50	100	3
6	Project	21XXP75	Project work	CV	Two contact hours /week for interaction between the faculty and student					100	100	200	10
			TOTAL							350	350	700	24

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY, BENGALURU

B.E. in Civil Engineering

Scheme of Teaching and Examination 2022-2023

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

(Effective from the academic year 2023-2024)

VIII SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week				Duration in Hours	Examination			Credits
					Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	**21CV81**		**Project Work/ Internship**	CV	One Contact hour/ week for interaction between the faculty and students				3 (Batch wise)	100	100	200	15
2	**21CV82**		**Technical seminar**	CV	Two Contact hour/ week for interaction between the faculty and students				-	100	-	100	1
3	NCMC	**21NS83**	**National Service Scheme (NSS)**	NSS	Complete during the intervening period of III semester to VIII Semester				-	50	50	100	0
		21PE83	**Physical Education (PE) (Sports and Athletics)**	PE									
		21YO83	**Yoga**	YO									
TOTAL												400	16

III SEM

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES			
Course Code	**21MAT31**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (2:2:0:0)	**Credits (2:2:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**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 differential equations arising in engineering applications, using numerical methods.
- To understand the method of solving the variational problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher 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 maybe adopted so that the delivered lessons shall develop students theoreticaland 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 of some exercises (post-lecture activity).

Module-1

Laplace Transform: Definition and Laplace transforms of elementary functions (statementsonly). 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 differentialequations. **08 Hours**

Self-study: Solution of simultaneous first-order differential equations.

[Text 1:21.1, 21.2, 21.3, 21.4, 21.5, 21.7, 21.9, 21.10,21.12, 21.14, 21.15, 21.17]

(RBT Levels: L1, L2 and L3)

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. Halfrange Fourier series. Practical harmonic analysis. **08 Hours**

Self-study: Convergence of series by D' Alembert's Ratio test and, Cauchy's root test.

[Text 1: 9.3, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.11]

(RBT Levels: L1, L2 and L3)

Module-3

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

Z-Transforms: Difference equations, z-transform-definition, Standard z-transforms, Damping and shifting rules,Problems. Inverse z-transform and applications to solve difference equations. **08 Hours**

Self Study: Initial value and final value theorems, problems.

[Text 1: 22.1, 22.2, 22.4, 22.5, 23.1, 23.2, 23.3, 23.5, 23.6, 23.7, 23.15, 23.16, 31.1, 31.2]

(RBT Levels: L1, L2 and L3)

Module-4

Numerical solutions of simultaneous first order differential equations: Picards method,Taylor's series method and Runge-Kutta method. (No derivations of formulae).

Second-order differential equations: Runge-Kutta method and Milne's predictor and Corrector method. (No derivations of formulae). **08 Hours**

Self Study: Solution of Laplace's equation using standard five-point formula.

[Text 1: 32.1, 32.11, 32.12. Text 2: 21.3]

(RBT Levels: L1, L2 and L3)

Module-5

Calculus of Variations: Functionals, Euler's equation, Problems on extremals of functional. Geodesics on a plane, Variational problems. **08 Hours**

Self Study: Hanging chain problem**.**

[Text 1: 35.1, 35.2, 35.3, 35.4, 35.5]

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able

1. To solve ordinary differential equations using Laplace transform.
2. Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
3. To use Fourier transforms to analyze problems involving continuous-time signals and toapply Z-Transform techniques to solve difference equations
4. To solve mathematical models represented by initial or boundary value problems involving ordinary differential equations
5. Determine the extremals of functionals using calculus of variations and solve problems Arising in dynamics of rigid bodies and vibrational analysis.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1- At the end of 5th week	20	60
	CIE 2 - At the end of 10th week	20	
	CIE 3 - At the end of 15th week	20	
AAT's	AAT-1- At the end of 4th week	10	40
	AAT-2- At the end of 9th week	10	
	AAT-3- At the end of 13th week	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

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. **B.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.

E-Resources:

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Quizzes**
- Assignments
- **Seminars**

CO- PO Mapping :

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAT31.1	3	1										
21MAT31.2	3	3										
21MAT31.3	3	2										
21MAT31.4	3	3										
21MAT31.5	2	2										

STRENGTH OF MATERIALS						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Hours**
21CVT32	**3-0-0-0**	**3**	**50**	**50**	**3 hours**	**40 hr**

Prerequisites:

- Basic Mathematics and Physics
- Engineering Mechanics

Course Objectives:

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 analyze 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 behavior of torsion members, columns and struts.

Syllabus

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

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**.** **8 Hrs**

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. **8 Hrs**

Module 3

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 including irregular shapes **8 Hrs**

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, Numerical Problems Thin cylinders: Introduction: Longitudinal, circumferential (hoop) stress in thin cylinders. Expressions forlongitudinal and circumferential stresses. Efficiency of longitudinal and circumferential joints. Problems onestimation of change in length, diameter and volume when the thin cylinder subjected to internal fluidpressure.

Thick cylinders: Concept of Thick cylinders Lame's equations applicable 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 **8 Hrs**

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, 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. (Derivation-Self-study component) **8 Hrs**

Course Outcomes:

- Evaluate the behavior 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.
- 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.
- Evaluate the behavior when a solid material is subjected to Torque and internal fluid pressure and estimate stresses and corresponding strain developed.
- Distinguish the behavior of short and long column and calculate load at failure & explain the behavior of Beamto estimate deflection and stiffness.

Text Books:

- Timoshenko and Young, "Elements of Strength of Materials" ,EastWest Press, 5t edition 2003
- R. Subramanyam, "Strength of Materials", Oxford University Press, 3rd Edition -2016
- B.C Punmia Ashok Jain, Arun Jain, "Strength of Materials", Laxmi - 2018-22 Publications, 10th Edition-2018.

Reference Books:

- Beer & Jhonson
- I B Prasad

E-Resources

- Strength of Materials web course by IIT Roorkee https://nptel.ac.in/courses/112107146/
- Strengthof Materials video course by IIT Kharagpur https://nptel.ac.in/courses/105105108/
- Strength of Materials video course by IIT Roorkee https://nptel.ac.in/courses/112107147/18
- All contents organized http://www.nptelvideos.in/2012/11/strengthof-materials-prof.html

POs & PSOs

PO'S / CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3												1		
C2	3	2											1		1
C3	3	2											1		1
C4		3	2										1		1
C5															
C	3	2.3	2										1		1

CONSTRUCTION MATERIALS AND TECHNOLOGY(IC)

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Hours
21CVI33	3-0-2-0	4	50	50	3 hours	50

Course Objectives:

The students will be able to
To gain knowledge of various materials and processes involved in building construction.To apply the knowledge for building planning and estimation.
To understand water proofing in different types of masonry.

Syllabus

Module – 1

INTRODUCTION TO CONSTRUCTION MATERIALS

Structural clay products: Bricks, Concrete blocks, manufacturing process of bricks.Natural stone: Types, qualities of good stone for construction.
Timber: Natural timber, properties, Timber products. Plywood, veneers, laminates
Lime, cement, admixtures: Properties and uses, Types, field test and manufacturing process **[10 hours]**

Module – 2

Introduction to building construction: Building components viz. foundations, walls, lintels roofs, openings, framed structures and masonry structures.
Foundation: Function and requirements of a good foundation, Types of foundations, Preliminary investigationof soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations.(Numerical problems on Combined footings- Reinforcement calculations not considered, Design of group pile and capacity of pile). **[10 hours]**

Module – 3

Masonry: Definition of terms used in Masonry, Classification of Masonry, Bonds in Brick work, Reinforced Brick Masonry, Joints in stone masonry, Introduction to load bearing, cavity and partition walls. (Numerical problems on Masonry wall Design – width and height calculations)
Damp proofing, water proofing and anti-termite treatment Definition of technical terms, Defects, causes and sources of dampness, damp proofing and terrace water proofing methods, Pre and post constructional anti termite treatment. **[10 hours]**

Module – 4

Modern materials

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products -Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles-Geo-membranes and Geo- textiles for earth reinforcement.
[8 hours]

Module – 5

Energy in building materials: Environmental issues related to Building Materials, Green Concept in Buildings.
Introduction to Construction Planning-Scheduling for activities- Critical path method (CPM) and PERTnetwork modelling [**10 hours]**

List of Experiments

Tests on Bricks (water absorption, dimension analysis, compressive strength).
Tests on coarse and Fine Aggregates (Specific Gravity, Sieve Analysis and loose and dense density test)
Tests on Cement, Specific Gravity, Normal Consistency, Initial Setting Time, Final Setting Time, Soundness of cement.
Charpy and Izod Impact test on Ductile Materials (Mild Steel)
Tension test (Mild Steel)
Bending test on Wood.
Hardness test: Brinnell's and Vicker's hardness test on Ductile Materials (Aluminum and Mild Steel)

[10 hours]

Course Outcomes:

Discuss the physical and mechanical properties of a variety of construction materials.Understand the importance of building components and building services.
Describe the construction process of various components of a building.
Understand the impact of building construction on society and demonstrate awareness of contemporary issues.

Text Books:

A Text Book Building Materials, by P.G. Varghese, Prentice-Hall of India Pvt. Ltd., Publication., 2nd Edition,.2015
Building Construction, Sushil Kumar, Standard Publication and Distributors, New Delhi, 19th Edition, 2001.
Building Construction, by Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, Laxmi Publications Pvt Ltd.

Reference Books:

Advances in Building Materials and Construction by Mohan Rai and M.P. Jain Singh – publication by CBRI, Roorkee.
Building Materials (3rd revised edition), S.K. Duggal, New Age International publishers, India.
Jagadish. K.S, "Alternative Building Materials Technology", New Age International, 2007.
M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi. Neville
AM, "Properties of Concrete", ELBS Publications, London.
L. S. Srinath PERT and CPM Principles and Applications Affiliated East-West Press 2001
Relevant BIS codes, Relevant IS Codes and IRC Codes.

POs & PSOs

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	1	1										1		
C2	2	1											1		
C3	2	1	2										1		
C4	2			3									1		
C5															
C	2.25	1	1.5	3									1		

GEODETIC ENGINEERING (IC)

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Hours
21CVI34	2-2-2-0	4	50	50	3 hours	50 Hrs

Prerequisites:

Mathematics
Civil Engineering Foundation
A good understanding of the above topics is essential.

Course Objectives:

This course enables the students to gain knowledge about the conventional, latest methods and instruments used for measuring distances, angles and elevation of objects. Students will be able to perform levelling to compute areas and volumes of the existing ground profile.

Syllabus

Module – 1 **[10 hours]**

Introduction to Surveying: Introduction to Surveying**,** Definition of surveying, Classification of surveying, Units of measurement, Basic principles of surveying, Precision and Accuracy.
Chain and tape measurement: Chain and types, Ranging of lines, Direct and indirect, Chain and tape corrections, Numerical Problems. **(6L+2T)**

Module – 2 **[10 hours]**

Compass Surveying: Meridians and bearing **-** Principle, working and use of Prismatic compass, Traverse – open and closed traverse, WCB and Reduced bearing, computation of included angles given the bearings of legs of a closed traverse.
Introduction to levelling: Principles and basic Definitions, Types of adjustments and objectives, Temporary adjustments of a dumpy level, booking of levels, Rise and Fall method and Height of Instrument method, Differential levelling, longitudinal & cross section levelling, refraction & curvature correction, reciprocal levelling**.** **(6L+2T)**

Module – 3 **[10 hours]**

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. Computation of distances and elevations using Tacheometric method.
Areas and Volumes: Calculation of area from cross staff surveying, Calculation of area of a closed traverse by coordinates method. Planimeter – principle of working and use of planimeter to measure areas, Computations of volumes by trapezoidal and prismoidal rule. **(6L+2T)**

Module – 4 **[10 hours]**

Curve Setting: Simple Curves - Necessity, types, Definitions, designation of curve, elements of simplecurve - settings of simple circular curve by linear method, setting out of simple curves by Rankines deflection angle method. compound and reverse curve- transition curve – Introduction to vertical curves. **(6L+2T)**

Module – 5 **[10 hours]**

List of Surveying Lab Experiments

Sl. No.	Name of the Experiment
1	Measurements of distances using tape along with horizontal planes and slopes, direct ranging. 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

4	To determine difference in elevation between two points using simple and differential leveling technique using both HI and Rise and Fall methods.
5	To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error.
6	To conduct profile leveling for water supply / sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level.
7	Measurement of horizontal angles with method of repetition using theodolite.
8	Measurement of vertical angles using theodolite.
9	To set out simple curves using linear methods–perpendicular offsets from long Chord.
10	To set out simple curves using Rankine's deflection angles method.
11	Traverse survey using total Station.

[10 hours]

Course Outcomes:

- Understand the basic concepts of surveying.
- Utilize different surveying instruments to solve problems by appropriate methods.
- Develop skill to carry out tachometry, geodetic surveying in the field.
- Explain latest technologies and modern instruments used in survey.
- Estimate the area of a given plot and quantities of earthwork involved in cuttings and fillings.

Text Books:

- Dr B C Punmia, "Surveying Volume I", (Chapter 1,2,3, 4, 6, 7, 9,10,11,12,13,16,18&22), Lakshmi Publications Pvt Ltd, 6th Edition, 2005, ISBN 978-81-700-8853-0
- Dr B C Punmia, "Surveying Volume II", (Chapter 1, 2, 3, 4, 6, 7 & 15), Lakshmi Publications Pvt Ltd, 6th Edition, 2005, ISBN 978-81-700-8853-0
- Kanetkar T P and S V Kulkarni, Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan,1988,

Reference Books:

- C Venkatramaiah, "Text Book of Surveying", (Chapter 1, 2, 3, 4, 5, 7, 8, 9, 10, 11& 12), Universities Press (India) Pvt. Ltd, 5th Edition, 1996.
- S.K. Roy, "Fundamentals of Surveying", (Chapter 1, 3& 19), Prentice-Hall of India Pvt. Limited, 2004, 2nd Edition, ISBN: 81-20-312-60-0.
- R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi, ISBN 10: 0198085427.

E-Resources

- http://lib.uniten.edu.my/libsite/index.php?option=com_joomd&view=item&layout=detail&typeid=2&id=202&Itemid=790
- http://ascelibrary.org/journal/jsued2
- www.survivorlibrary.com/.../engineers_surveying_instruments_1892.pdf

Online Courses and Video Lectures

- https://www.udemy.com/course/surveying/
- https://www.udemy.com/course/total-station-surveying-and-mapping/
- https://www.udemy.com/course/advanced-surveying-technology/
- https://nptel.ac.in/courses/105107122

POs & PSOs															
PO'S CO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
C1	3	2				1							2	2	1
C2	3	2		1		1							3	2	1
C3	3	2				1							2	2	1
C4	3	2	1		3	1						2	3	2	2
C5	3	2										2	3	2	1
C	**3**	**2**	**1**	**1**	**3**	**1**						**2**	**2.6**	**2**	**1.2**

BUILDING PLANNING AND DRAWING LAB –I						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Hours**
21CVL35	**0-0-2-0**	**1**	**50**	**50**	**3 hours**	**20 Hours**

Prerequisites:

Students should know to identify different types of various components of building.

Course Objectives:

To enable students to gain drafting knowledge, visualize the various components of a building and design a building. This will enable students to design and draw the various types of buildings based on the given functional requirements.

MODULE 1

Development of plan, elevation, section and schedule of openings for the given line diagram of residential buildings such as;

i) Single bed room single story buildings,

ii) Two bed room single story buildings and

iii) Two storied buildings (Only for Practice) **[5 hours]**

MODULE 2

To prepare geometrical drawing of various component of buildings such as i) Stepped wall footings, ii) Isolated and combined RCC column footings, iii) RCC dog legged and open newel stair cases, iv) Doors & windows (Fully paneled doors & glazed windows) **[5 hours]**

MODULE 3

Functional design of buildings using inter connectivity diagrams (bubble diagram), development of line diagram of residential buildings, public buildings such as Primary Health Centre, office buildings and school buildings. **[5 hours]**

MODULE 4

Preparation of water supply, sanitary and electrical layouts for a given single line diagram. **[5 hours]**

Course Outcomes:

CO1: Develop drawings from given line diagram.

CO2: Prepare drawings of various components of buildings.

CO3: Design and draw the various types of buildings as per requirements and develop drawings showing the interconnectivity of functional components of buildings.

CO4: Prepare service layouts.

Text Books:

1. Building Drawing", by Shah M. H. And Kale C. M., Tata McGraw Hill Publishing Co. 2002
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. A Course in Civil Engineering Drawing", by V. B. Sikka, S. K.Kataria& Sons.
2. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
3. IS:962- Code of practice for architecture and building drawing National Building code, BIS, New Delhi

POs & PSOs															
PO'S CO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
C1	2				2	3	2	2	2				2	2	2
C2	1				3	3	2	2	2				2		
C3	2				3	3	2	2	2				2		
C4	2				3	3	2	2	2				2		
C5															
C	**1.75**				**2**	**3**	**2**	**2**	**2**				**2**	**2**	**2**

SOCIAL CONNECT & RESPONSIBILITY

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Hours
21UHV36	0-0-2-0	1	50	50	3 hours	15 Hrs

Prerequisites:
Society, Constitution, Ethics and Environment.

Course Objectives:

The Course will

1. Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & the government and build solutions to alleviate these complex social problems through immersion, design & technology.
2. Provide a formal platform for students to communicate and connect with their surroundings.
3. Enable to create of a responsible connection with society.

Learning Outcomes:

The students are expected to have the ability to :

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Contents:

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage students interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed.

Module – 1	**[3 hours]**
Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.	
Module – 2	**[3 hours]**
Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connectingto people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.	
Module – 3	**[3 hours]**
Organic farming and waste management: usefulness of organic farming, wet waste management in neighboring villages and implementation in the campus.	
Module – 4	**[3 hours]**
Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.	
Module – 5	**[3 hours]**
Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking.	
Teaching Learning Process	Chalk and Board, Active Learning, PPT based Presentation, Video

Activities

Jamming session, open mic, and poetry: Platform to connect to others. **Share the stories with others.** Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

A total of 14-20 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into 10 groups of 35 each. Each group will be handled by two **faculty mentors**. Faculty mentors will design the activities (particularly Jamming sessions open mic ,and poetry)

Faculty mentors has to design the evaluation system.

Guideline forAssessment Process:

Continuous Internal Evaluation (CIE)

After completion of, the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

Marks allotted for the diary are out of 50.

Planning and scheduling the social connect

Information/Data collected during the social connect

Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below:-

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59
Unsatisfactoryand fail	<39

Semester End Examination (SEE)

This **Jamming session** will be conducted at the end of the course for **50 marks**

Jamming session includes -Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art painting, and fine art.

Faculty mentor has to design the evaluation system for the Jamming session.

POs & PSOs															
PO'S CO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
C1	2					2	3			2		2	3		
C2	2				3		3			2		1	2		
C3	2				1					2		3	3		
C4															
C5															
C	**2**				**2**	**2**	**3**			**2**		**2**	**2.6**		

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Hours
21CPC37	1:0:0:0	01	50	50	03	15

Course objectives:

This course will enable students to:

1. The basic information about the Indian constitution.
2. The fundamental rights and duties of a citizen.
3. Special privileges of socially and economically weaker sections of society.
4. Individual role and ethical responsibility towards society.
5. Understand the categories in the Indian Government

Teaching-Learning Process (General Instructions):

1. These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
2. 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 to current scenario and improve their skills.
3. Gain knowledge of fundamental concepts of democracy.
4. Analyze the political situations based on the fundamental rights.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   a) As an introduction to new topics (pre-lecture activity).
   b) As a revision of topics (post-lecture activity).
   c) As additional examples (post-lecture activity).

Module-1

Introduction to the Constitution of India, The making of the constitution and salient features of the Constitution. Preamble to the Indian constitution, Fundamental rights & its limitations. **03 Hours**

Module-2

Directive Principles of State policy &relevance of Directive principles of state policy, Fundamental duties. Union executives – President, Prime Minister, Parliament, Supreme Court of India. **03 Hours**

Module-3

State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th, & 91st Amendments. **03 Hours**

Module-4

Special Provision for SC & ST, Special Provision for Women, Children & Backward Classes, Emergency Provisions. Human Rights- Working of National Human Rights Commission in India, Powers and functions of Municipalities, Panchayats and Co - Operative Societies. **03 Hours**

Module-4

Scope & Aims of Engineering Ethics, Responsibility of Engineers, Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering. **03 Hours**

Teaching-Learning Process for all modules	**Chalk and Talk, Power point presentation, flip teaching, YouTube videos**

Course Outcomes

On completion of this course, the students will be able to

1. Familiarize with fundamental rights and duties.
2. Recognize the Electoral Process.
3. Get exposed to legislature and judiciary.
4. Realize special provisions given for women, children and weaker section of society.
5. Exhibit Engineering ethics and responsibilities of Engineers

Assessment Details (both CIE and SEE)

Component		**Weight age (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 4th week	10	
	AAT-2 9th week	10	
	AAT-3 13th week	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India", Lexis Nexis Publications; 22nd Edition, 2015, ISBN-13: 978-9351434467.
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins, "Engineering Ethics", Thomson Wadsworth, 2nd Edition, 2003, ISBN-13: 978-9812436764.

Reference Books:

1. M.V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002, 1st Edition, ISBN-13: 978-8125918325.
2. M. Govindarajan, S. Natarajan, V.S. Senthilkumar, "Engineering Ethics", PHI Learning Private Limited, New Delhi, 2nd Edition, 2013, ISBN-13: 978-8120348165
3. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Private Limited, New Delhi, 7th Edition, 2015, ISBN-13: 978-8120350892.

E-Resources:

1. http://www.cgsird.gov.in/constitution.pdf
2. http://indiacode.nic.in/coiweb/welcome.html

POs & PSOs															
PO'S CO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
C1												1			
C2										1		2			
C3										1		2			
C4										2		2			
C5										2		2			
C										**1.5**		**1.8**			

BUILDING SERVICES

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Hours
21AEC38A	1-0-0-0	1	50	50	3 hours	15 Hours

Prerequisites:

Building planning, building materials

Course Objectives:

Students will be able to understand different types of services provided in the building and gain knowledge about the building services and layout as per the building. Also, the student will learn about the various methods of maintenance in construction industry.

Syllabus

Module – 1 **[3 hours]**

Introduction to Building Services. Definition of building services. Classification of building services. Introduction to Fire and Life safety: causes of fire, fire classification of buildings, fire water storage requirements, fire control room, code of practices.

Module – 2 **[3 hours]**

Electrical services in the building, Technical terms and symbols for electrical installations, electrical layout of building (ex- residence, small work shop, show room, school building) and Type of cold and hot water systems.

Module – 3 **[3 hours]**

Lifts and Escalators –Definition and types of lifts and escalators, location and sizes as per NBC 2005, different type of conveyors.

Module – 4 **[3 hours]**

Need for maintenance- objectives, types of maintenance, factors influencing maintenance, Agencies causing deterioration.

Module – 5 **[3 hours]**

Building Maintenance- common building defects and their Symptoms (identifying the cracksin structures), preventive and remedial measures for defects in building components, developing a repair budget.

Course Outcomes:

On completion of this course, students are able to

1. Manage the building services provisions in big construction sites.
2. Select the suitable electrical as well mechanical services for particular requirements of buildings.
3. Synchronize the construction activities with installation of building services
4. Choose the appropriate type of maintenance depending upon necessity and requisite budget.

Text Books:

1. S. M. Patil "Building Services" Seema Publication, Mumbai Revised second edition. ISBN no : 8175259805
2. R. Udaykumar "Building Services" ,,Eswar Press -Chennai , ISBN NO-9788178740638
3. NBC" Relevant Parts: BIS New Delhi,ISBN NO-81-7061-026-5

Reference Books:

1. Jain V K," Services in Building Complex and High Rise Buildings", Khanna Publishers, ISBN NO-. 978-81-7409-245-8
2. Current literature"

E-Resources

- http://civildigital.com/pavement-design-road-construction-design-parameters/http://civildigital.com/pavement-design-examples/

Online Courses and Video Lectures

NPTEL/SWAYAM

POs & PSOs															
PO'S CO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
C1						2	1	3				1			3
C2								2				1	1		
C3						3		2				1			2
C4						2	1					1			
C5															
C						**2.3**	**1**	**2**				**1**	**1**		**2.5**

IV SEM

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL INFERENCE

Course Code	L: T: P: S	Total Hours of Pedagogy	Credits	CIE Marks	SEE Marks	Exam Hours	Course Type
21MAT41	2:2:0:0	40 hours	03	50	50	03	BSC

Course objectives:

The goal of the course Complex Analysis, Probability and Statistical Inference -21MAT 41 is

- Provide insight into applications of complex variables, conformal mapping arising in potentialtheory, quantum mechanics, heat conduction and field theory.
- To have insight into Statistical methods, Correlation and regression analysis.
- To develop probability distribution of discrete and continuous random variables, Markov chain, Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering.
- To understand the concept of sampling and inference.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher 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 maybe 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 of some exercises (post-lecture activity).

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.

[Text 1: 20.1, 20.2, 20.3, 20.4, 20.5, 20.6, 20.12, 20.13, 20.14]

(RBT Levels: L1, L2 and L3)

Module-2

Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b$, $y = ax^b$, $= ax^2 + bx + c$.

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems. **8 Hours**

Self-study: Fitting of the curve $y = ax^b$. Angle between two regression lines, problems.

[Text 1: 24.1, 24.4, 24.5, 24.6, 25.12, 25.13, 25.14, 25.16]

(RBT Levels: L1, L2 and L3)

Module-3

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

[Text 1: 26.1, 26.2, 26.7, 26.8, 26.9, 26.10, 26.13, 26.14, 26.15, 26.16]

(RBT Levels: L1, L2 and L3)

Module-4

Markov's Chain: Probability vectors, stochastic matrices, fixed point matrices, regular stochastic matrices, Markov's Chains, higher transition probabilities, stationary distribution of regular Markov's Chains.

Joint probability distribution: Joint Probability distribution of two discrete random variables. Expectations, covariance and correlation. **8 Hours**

Self-Study: Joint Probability distribution of two continuous random variables

[Text 3: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 5.6, 5.7]

(RBT Levels: L1, L2 and L3)

Module-5

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.

Self-Study: Point estimation and interval estimation. **8 Hours**

[Text 1: 27.1, 27.2, 27.3, 27.4 27.5, 27.6, 27.7, 27.9, 27.10, 27.11, 27.12, 27.13, 27.14, 27.15, 27.16, 27.17, 27.18]

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able

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. Make use of the correlation and regression analysis to fit a suitable mathematical model for thestatistical data.
3. Apply discrete and continuous probability distributions in analysing the probability models arisingin the engineering field.
4. Use Markov's chains in analyzing the probability models arising in engineering field and Construct joint probability distributions.
5. Demonstrate the validity of testing the hypothesis.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1- At the end of 5th week	20	60
	CIE 2 - At the end of 10th week	20	
	CIE 3 - At the end of 15th week	20	
AAT's	AAT-1- At the end of 4th week	10	40
	AAT-2- At the end of 9th week	10	
	AAT-3- At the end of 13th week	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

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.
3. **Seymour Lipschutz and Marc Lars Lipson:** "Probability", (Chapters: 5 and 8), McGraw Hill Education (India) Private Limited, Chennai, Special Indian Edition, 2010,

Reference Books:

1. **B. V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed 2010.
2. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 2014.
3. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co.Newyork, Latest ed.
4. **Chandrika Prasad and Reena Garg:** Advanced Engineering Mathematics, Khanna Publishing, 2018

E-Resources:

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

CO- PO Mapping :

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAT41.1	3	1										
21MAT41.2	3	3				2						
21MAT41.3	3	2				2						
21MAT41.4	3	3				2						
21MAT41.5	2	2				2						

Structural Analysis						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Hours**
21CVT42	**2-2-0-0**	**3**	**50**	**50**	**3 hours**	**50**

Prerequisites:

Basic concepts of physics and mathematics. Analysis of forces systems with different structures.

Course Objectives:

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.

Syllabus

Module – 1

Structural Systems and Deflection of beams - Forms of Structures, Conditions of Equilibrium, Degrees of Freedom. Linear and Non-Linear Structures. *Conjugate beam method* – Real beam and conjugate beam, conjugate beam theorems; Application of conjugate beam method to determinate beams of varying cross sections.

(10 hours)

Module – 2

Energy Principles and Energy Theorems: Definition, Strain, Bending and Shear, Theorem of minimum Potential energy,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. **(10 hours)**

Module – 3

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams. Analysis of rigid plane frames with kinematic indeterminacy up to 3.

Matrix Methods of Structural Analysis: Definition of stiffness and flexibility methods, comparison to classical methods

[10 hours]

Module – 4

Stiffness Method: Stiffness matrix, Analysis of continuous beams and plane trusses using system approach; Analysis of simple plane frames using system approach with kinematic indeterminacy up to 3.

(10 hours)

Module – 5

Arches and Cables: Introduction, Three-hinged circular and parabolic 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 with supports at the same and different levels; Stiffening trusses for suspension cables.

(10 hours)

Course Outcomes: An ability to

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. Apply slope defection method in analysing indeterminate structures and construct bending moment
4. Analyse continuous beams, frames and trusses using stiffness matrix method of analysis.
5. Analyse arches and cables for stress resultants.

Text Books:

- V.N Vazirani: "Analysis of Strucures Vol. 1:Analysis,Design And Details of Structures". International Student Edition, Mcgraw Hill Book Co., New York,2008,ISBN:978-8174091406.
- S S Bhavikatti: "Structural Analysis – Vol.I", Vikas Publishing House, 4 th Edition, 2009,ISBN:9788125927907.
- Theory of Structures, S.Ramamrutham,9th Edition, 2014,Dhanpat Rai Publishing Company Private Limited, New Delhi; ISBN – 13 :978-9384378103.

Reference Books:

- Structural Analysis, R C Hibbler,8th Edition, 25 February 2011, Pearson Publication; Pearson Prentice Hall,ISBN-13;978-0132570534.
- Elementary Structural Analysis, Norris C.H., Wilbur J B., International Student Edition, 2005,McGraw Hill international 121 Book, ISBN 13;978-8131721414.
- Basic Structural Analysis, Reddy C.S.,3rd Edition, 1 July 2017,Tata McGraw Hill Publication Company Ltd.,New Delhi; ISBN – 13 :978-0070702769.
- Structural Analysis by K.V Muthu, PHE Publications.

E-Resources

- https://eng.libretexts.org/Bookshelves/Civil-Engineering/Book%3A-Structural-Analysis (Udoeyo)/01%3A-Chapters/1.01%3A-Introducton-to-Structural-Analysis.
- https://onlinecourses.nptel.ac.in/noc20-ce35/preview
- https://vdocument.in/structural-analysis-nptel.html

Online Courses and Video Lectures

- 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

POs & PSOs

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
C2	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
C3	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
C4	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
C	**3**	**3**			**1**	**2**		**1**				**3**	**3**	**3**	

PUBLIC HEALTH ENGINEERING (IC)						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Hours**
21CVI43	**2-2-2-0**	**4**	**50**	**50**	**3 hours**	**50**

Prerequisites:

Basic knowledge of water cycle, water resources, pollutants.

Course Objectives:

- To analyse the variation of water demand and to estimate water requirement for a community.
- To study the drinking water quality standards and to illustrate qualitative analysis of water.
- To understand and design of different unit operations and unit process involved in water treatment process.

Syllabus

Module – 1 [10 hours]

Demand of Water: 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: factors governing the design periods, population forecasting, different methods with merits and demerits, Numerical Problems on different population forecasting methods. **(8L+2T)**

Module – 2 [10 hours]

Sources and Collection of Water: Surface and Subsurface Sources – With regard to quality and Quantity. Intake structures - types of intakes –Factors to be considered in selection of intake structures.

Water quality Characteristics: Sampling objectives, significance and techniques, Methods, Preservation techniques. Physical, chemical and biological characteristics of water. Drinking water quality standards, BIS and WHO guidelines. **(8L+2T)**

Module – 3 [10 hours]

Purification of Water: Objectives, unit operations and unit processes, Treatment Flow chart – Significance of each unit. Screening, Types of screens, design, Sedimentation -theory, settling tanks, types, design.

Coagulation: Different types of coagulants (Optimisation of coagulant to be carried out in the laboratory), sedimentation aided with coagulation, chemical feeding, flash mixing, Flocculation. Optimum dosage of coagulant – Jar test apparatus (Analysis to be conducted in laboratory session). **(8L+2T)**

Module – 4 [10 hours]

Filtration: Mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system.

Disinfection and Water softening: Methods of disinfection with merits and demerits, Chlorination, types of chlorination (Analysis to be conducted in laboratory session for Breakpoint chlorination). Numerical problems, Water Softening: Lime soda and Zeolite process. **(8L+2T)**

Module – 5 **[10 hours]**

Sanitation: Need for sanitation, methods of sewage disposal, types of sewerage systems, conservancy, public latrine, concept of Eco – Sanitation, trenching and composting methods, two pit latrines, aqua privy, septic tank, soak pit.

Water borne and Communicable diseases: Different types of water borne diseases, general methods of control. Communicable diseases: terminologies, methods of transmission, general methods of control.

List of Experiments

Experiments to be carried out are:

1. Determination of pH, Conductivity and Turbidity.
2. Determination of Acidity and Alkanity.
3. Determination of Calcium, magnesium and Total hardness.
4. Determination of solids in sewage
5. i) Total solids, ii) suspended solids, iii) Dissolved solids iv) Volatile solids, fixed solids and v) settle able solids.
6. Determination of Chlorides.
7. Determination of Dissolved Oxygen.
8. Determination of Biochemical Oxygen Demand.
9. Determination of Chemical Oxygen Demand.
10. Determination of percentage of available chlorine, Residual Chlorine and Chlorine demand.
11. Determination of Optimum dosage of coagulant using Jar test apparatus.
12. Determination of phosphates, Nitrates, Iron and Manganese using spectrophotometer.
13. Air Quality Monitoring (Ambient, Stack Monitoring, Indoor Air Pollution) Demonstration.

Course Outcomes: An ability to

- Understand the different types of water demand and design period.
- Estimate future population by different population forecasting methods.
- Evaluate water quality and environmental significance of various water quality parameters with respect to public health and safety and suggest suitable water treatment systems.
- Design the different units of water treatment plant.
- Achieve knowledge on sanitation and different types of communicable diseases.
- Acquire capability to conduct experiments and estimate the concentration of different pollution parameters and compare the obtained results with the concerned guidelines and regulations.

Text Books:

- 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

- Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013.

Reference Books:

- 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.

E-Resources

- https://nptel.ac.in/courses/105105178
- https://nptel.ac.in/courses/105106119

Online Courses and Video Lectures

- https://nptel.ac.in/courses/105105178
- https://nptel.ac.in/courses/105106119

POs & PSOs

PO'S / CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1															
C2	1														
C3	1	2	3			3	3	3				3			2
C4			3					2							3
C5						2	2								2
C6	1	3	3			3	3	3	3	3		3			3
CO	**1**	**2.5**	**3**			**2.66**	**2.66**	**2.66**	**3**	**3**		**3**			**2.5**

Fluid Mechanics and Machinery (IC)						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Hours**
21CVI44	**2-2-2-0**	**4**	**50**	**50**	**3 hours**	

Prerequisites:

Basic concepts of Engineering Mechanics, Force systems. Knowledge about fluids and hydraulic machines.

Course Objectives:

This course will enable students to gain knowledge on basic principles of fluid mechanics, hydrostatics, hydrodynamics, hydraulic machines and their applications to Civil Engineering. Also enable to solve problems associated with pipe flow and open channel flow.

Syllabus

Module – 1 [10 hours]

FLUIDS & PROPERTIES : Definition of fluid and their properties, Fluid pressure measurements, Newton's law of viscosity(problems), Newtonian & non-Newtonian fluids, ideal & real fluids , Pascal's law, Measurement of pressure using manometer (Simple & Differential manometers).

HYDROSTATICS: Total pressure and centre of pressure on vertical and inclined plane surfaces (problems), Pressure diagram.. **(8L+2T)**

Module – 2 [10 hours]

KINEMATIC: Types of fluid flow, continuity equation in Cartesian coordinates, flow nets, Classification of fluid flow, Stream line, Streak line, Path line, Stream tube.

DYNAMICS: Euler's equation of motion, Bernoulli's equation, Application-Venturimeter, Orificemeter, Pitot tube. **(8L+2T)**

Module – 3 [10 hours]

FLOW MEASUREMENT: Concept of Venturimeter, Orifimeter, 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, Darcy-Weisbach Equation, Hydraulic Gradient Line, Total energy line. (Numerical problems). **(6L+4T)**

Module – 4 [10 hours]

FLOW IN OPEN CHANNELS: Classification of Flow through channels, Most economical channel sections: Rectangular, Triangular, trapezoidal (Uniform flow) - derivations.

IMPACT OF JET ON VANES: Force exerted by a jet of water on fixed plates- vertical, inclined, symmetrical curved plates. **(6L+4T)**

Module – 5 [10 hours]

CENTRIFUGAL PUMPS: Definition and classification Centrifugal pumps, Work done and efficiency, Multi stage pumps, Pumps in series and parallel.

TURBINES: Definition and classification turbines, Pelton wheel and components, Velocity triangle, Reaction turbine-Francis turbine, Working proportions. **(6L+4T)**

List of Experiments

1. Verification of Bernoulli's Equation.
2. Determination of Coefficient of discharge through Venturimeter and Orificemeter.
3. Determination of Major losses in pipes.
4. Determination of Coefficient of discharge through Venturiflume.
5. Calibration of Triangular notch, Rectangular notch.
6. Determination of Coefficient of discharge for 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 Pelton wheel turbine.
10. Determination of efficiency of Kaplan or Francis turbine.

Course Outcomes:

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

1. Understand fundamental properties of fluids and solve problems on Hydrostatics
2. Identify fundamental kinematics, dynamics of a fluid element and calculate discharge through pipes, irrigation channels and water supply pipe lines .
3. Measure the loss of head in pipes and channels.
4. Compute discharge through pipes, notches, weirs and open channels of various cross sections
5. Differentiate between different type of water pumps, turbines and understand their operation characteristics

Text Books:

- P.N.Modi and S.M.Seth-Hydraulics and Fluid Mechanics, including Hydraulic machines, standard Book House, New Delhi , 20th Edition, 2015, ISBN 9788189401269.
- K Subramanya- Fluid Mechanics and Hydraulic Machines, Tata McGrawhill, New Delhi, 1st edition May 23, 2013, ISBN-13:978-1259006845.
- R.K. Bansal- A text book of Fluid Mechanics and Hydraulic Machines- Laxmi Publications ,New Delhi , 2010, ISBN:9788131808153.
- S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011, ISBN: 9780071329194.

Reference Books:

- Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford- Fluid Mechanics ,Tata McGraw Hill publishing Co Ltd,New Delhi.
- J.F.Douglas,J .M .Gasoreik, John Warfield ,Lynne Jack – Fluid Mechanics ,Pearson ,Fifth edition.
- C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, "Fluid Mechanics and ISBN: 9780195699630.
- S.K SOM and G.Biswas – " introduction to Fluid Mechanics and Fluid Machines, Tata Mcg raw Hill, New Delhi, 3rd edition, 2011, ISBN: 9780071329194.

E-Resources

- https://searchworks.stanford.edu/view/10496310
- https://searchworks.stanford.edu/view/13576277
- https://searchworks.stanford.edu/view/11842972
- http://elearning.vtu.ac.in/10CV35

Online Courses and Video Lectures

- http://nptel.ac.in/courses/105103192

POs & PSOs														
PO'S CO'S	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	2										1	3	2	
C2	3	2		2								1	3		
C3	3	2		2								1	1		
C4	3	2		2					1			2	1		
C5	3	2		2					1			2	2		
C	3	2		2					1			1.4	2	2	

Building construction and planning lab

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
21CVL45	2-0-0-0	1	50:50	3 hours	PCC

Prerequisites:

Students should know to identify different types of various components of building.

Course Objectives:

To enable students to gain skill set to prepare computer aided engineering drawings, visualize the various components of a building and the details of construction based on the engineering drawings. Understanding the details of construction of different building elements.

List of Experiments

1. Simple Engineering Drawings with CAD Tools.
2. Drawing plan, elevation and sectional elevation using CAD software for Single strorey residential building.
3. Drawing plan, elevation and sectional elevation using CAD software for Double strorey residential building.
4. Drawing of plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for Hostel building.
5. Drawing of plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for Hospital building.
6. Drawing of plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for School building.
7. Three-Dimensional Drawing of plan, elevation and sectional elevation including using CAD software for Double strorey residential building.
8. Three-Dimensional Drawing of plan, elevation and sectional elevation CAD software for Three strorey residential building.

Course Outcomes:

During the course of study students will develop understanding of:

- Prepare, read and interpret the drawings in a professional set up.
- Develop drawings from given line diagram.
- Know the procedures of submission of drawings and Develop working and submission drawings for building.
- Prepare Service layouts.
- Plan and design of residential or public building as per the given requirements.

Text Books:

- MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata McGraw Hill Publishing co. Ltd, New Delhi.
- Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
- Malik RS and a Meo GS, "Civil Engineering Drawing", Asian Publishers/Computech Publication Pvt Ltd

Reference Books:

- "A Course in Civil Engineering Drawing", by V. B. Sikka, S. K.Kataria& Sons.
- Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
- IS:962- Code of practice for architecture and building drawing National Building code,
- BIS, New Delhi

E-Resources:

-

POs & PSOs															
PO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
PSO'S															
CO.1	**2**				**2**	**3**	**2**	**2**	**2**				**2**	**2**	**2**
CO.2	**1**				**3**	**3**	**2**	**2**	**2**				**2**		
CO.3	**2**				**3**	**3**	**2**	**2**	**2**				**2**		
CO.4	**1**				**1**	**1**	**1**								
CO.5	**2**				**3**	**3**	**2**	**2**	**2**				**2**		

Internship – I					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
21INT46	**0-2-0-0**	**2**	**100**	**3 HOURS**	**INT**

Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh pass–outs in gaining professional know-how and benefits corporate sectors. The internship also enhances the student's employability skills passing out from Technical Institutions.

Following are the intended objectives of internship training;

(i) Expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence create competent professionals in the industry.

(ii) Provide possible opportunities to learn, understand and sharpen the real-time technical/managerial skills required at the job.

(iii) Get exposed to the current technological developments relevant to the subject area of training.

(iv) Use the experience gained from the industrial internship in discussions held in the classrooms.

(v) Create conditions conducive to the quest for knowledge and its applicability on the job.

(vi) Learn to apply Technical knowledge in real industrial situations.

(vii)
Gain experience in writing reports in Technical works/projects.

(viii) Expose students to the engineer's responsibilities and ethics.

(ix) Familiarize with various materials, processes, products, and applications along with relevant aspects of quality control and safety measures.

(x) Promote academic, career, and/or personal development.

(xi) Expose the students to future employers.

(xii) Make students available to industry for employment.

(xiii) Understand the psychology of the workers and their habits, attitudes, and approach to problem-solving.

(xiv) Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations

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**.**

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK37/47	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	01 ಗಂಟೆ

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ಪ್ರಕ್ರಿಯೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. **ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.**
2. **ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಪಿಪಿಟಿ, ಡಿಜಿಬಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.**
3. **ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.**

ಘಟಕ -1 ಲೇಖನಗಳು

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜೆ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಅಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೋ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**

ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	
1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. 2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂದ, ತಾಳು ಮನವೇ - ಕನಕದಾಸರು 3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚರ್ಚೆಯ ಮೂಲಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ	
1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚರ್ಚೆಯ ಮೂಲಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚರ್ಚೆಯ ಮೂಲಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	
1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ 2. ಮೊಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚರ್ಚೆಯ ಮೂಲಾಂತರ ಚರ್ಚಿಸುವುದು.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (course Outcomes):

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಮೌಲ್ಯಮಾಪನದ ವಿಧಾನ (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.

<u>ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - Semester End Exam (SEE):</u>

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.

ಪಠ್ಯಪುಸ್ತಕ :

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

BE - III / IV Semester – Common to All

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KBK37/47	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು (Semester End Examination Marks)	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	01 ಗಂಟೆ

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (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.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸಿಕೊಳ್ಳಬೇಕು.
1. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕ್ಕೆಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
2. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

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. ನೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - **Personal Pronouns, Possessive Forms, Interrogative words**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-2	
1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns** 2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ಪರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals** 3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಲಿ, ಅಯಿ, ಅಳ್ಳಿ, ಅದ್ಲಿ) **Predictive Forms, Locative Case**	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
Module-3	
1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – **Dative Cases, and Numerals** 4. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು – **Ordinal numerals and Plural markers** 5. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ಪರ್ಣ ಗುಣವಾಚಕಗಳು **Defective / Negative Verbs and Colour Adjectives**	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
Module-4	
1 ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು **Permission, Commands, encouraging and Urging words (Imperative words and sentences)** 2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು **Accusative Cases and Potential Forms used in General Communication** 3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs 6. ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparitive, Relationship, Identification and Negation Words	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
Module-5	
1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - ifferent types of forms of Tense, Time and Verbs 2. ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms 3. **Kannada Vocabulary List** : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - **Kannada Words in Conversation**	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಬಳಕೆ ಕನ್ನಡ ವಿಷಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು: **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.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - 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 :

ಬಳಕೆ ಕನ್ನಡ

ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Earth Sciences Engineering

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Course Type
21AEC49A	2-0-2-0	3	50	50	3 hours	AEC

Prerequisites:

Basics of Geology and Civil Engineering Knowledge

Course Objectives:

To make students to learn

- The Principles of Engineering Geology and Properties Earth resource.
- Earth processes and natural hazards.
- Natural Building Materials and their properties.
- Geological structures and their impact on engineering construction.
- Water resource management and conservation.

Syllabus

Module – 1 [8 hours]

INTRODUCTION: Geology and its role in the field of civil engineering. Earth: Its internal structure and composition.

MINERALOGY : Description and identification of Rock forming minerals and Ores, based on physical and special properties;

Quartz and its varieties; Feldspar group; Mica group; carbonate group; Hornblende, Olivine, Asbestos, Talc, Gypsum, Garnet, Corundum. Magnetite, Hematite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Psilomalane, Chromite, Galena, Bauxite. **(8L)**

Module – 2 [8 hours]

GEOMORPHOLOGY :Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures; Geological action of rivers with different drainage patterns; Geological action of wind. Coastal zones, coastal landforms, continental shelf, continental rise, continental slope, abyssal plain, mid-oceanic ridges, trenches, tsunamis. Landslides; causes effects and remedial measures. **(8L)**

Module – 3 [8 hours]

PETROLOGY: Rocks as fundamental units and building materials of the earth crust and their engineering applications: As building stones, road metals and stones for decoration, pavement, cladding, roofing, flooring, concreting and foundation engineering. Rock Cycle.

Igneous rocks: Origin, classification (chemical and textural), mode of occurrence; Granite, Gabbro, syenite, Basalt

Sedimentary Rock: Origin, classification, mode of occurrence Sandstones, Conglomerate, Breccia, Shale, Lime stones and Laterite.

Metamorphic rocks: Kinds of metamorphism, description of Gneiss, Quartzite, Marble, Slate, Phyllite and Schists. **(8L)**

Module – 4 [8 hours]

ROCK MECHANICS AND ENGINEERING GEOLOGY:

Deformational effects on different rocks; Out crop, Dip, strike and escarpment, Clinometer-compass- Joints, faults, folds and unconformities their effects on civil engineering structures. Earthquakes- seismic waves, seismograph, causes, effects, seismic zones, shield areas and seismic resisting structures.

Geotechnical investigations for civil engineering projects: Study of toposheets and geological maps, importance of lithological and structural features studies for the construction of Dams, Reservoirs, Tunnels, Bridges and Highways.**(8L)**

Module – 5 [8 hours]

HYDROGEOLOGY: Hydrological cycle; distribution of ground water in the earth crust; properties of water bearing geological formation: Aquifers and their types; selection of sites for well locations and spacing of wells; geological, hydrological and geophysical investigations for ground water exploration; artificial recharge of groundwater methods and rainwater harvesting. Sea water intrusion and remedial measures. **(8L)**

Course Outcomes:

Students will be able to

1. Assess the knowledge of earth and its internal structure.
2. Explain Earth process and its effect on engineering construction.
3. Recognize good building materials and their properties.
4. Identify the earth Structure due to rock deformation and its impact on environment.
5. Assess the hydrological condition of the Geological terrain.

Text Books:

1. Text book of Geology by P.K. Mukerjee, World Press Pvt.Ltd.Kolkatta. ISBN-13 9788187567547
2. Foundations of Engineering Geology, by Tony Waltham (3rdEd.) Universities Press.ISBN 9780415469609
3. Principles of Engineering Geology and Geotechnics by Dimitri P. Krynine and William R. Judd.ISBN 13: 9788123906034
4. Text of Engineering and General Geology by Parbin Singh, Published by S. K. Kataria and Sons, New Delhi. ISBN: 8188458511, 9788188458516.
5. SatyanarayanaSwamy B.S. (1985) Engineering Geology Laboratory Manual, Eurasia Publishing House, New Delhi

Reference Books:

1. Rock Mechanics for Engineers by Dr. B. P. Verma, Khanna Publishers, New Delhi.
2. Ground water geology by Todd D.K. John Wiley and Sons, New York.
3. Physical Geology by Arthur Holmes, Thomson Nelson and Sons, London. Ground water assessment, development and management by K. R.

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/105105106

POs & PSOs

PO'S / CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	2		1									1	3	1
C2	2	3	1	2									1	3	1
C3	3	2				1							1	3	1
C4	2	3	1										2	3	1
C	3	2		1			1						1	3	3

UNIVERSAL HUMAN VALUES

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
21UHV49B	0-2-0-0	1	50:50	3	HSMC

Course Objectives:

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- 2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- 3. Strengthening of self-reflection.
- 4. Development of commitment and courage to act.

Syllabus

Module – I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2.Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module – II

Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module – III

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module – IV

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of peoplefriendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Course Outcomes:

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as "H-102 Universal Human Values 2: Understanding Harmony" is designed which may be covered in their III or IV semester.

During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

Text Books:

- Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

ference Books:

- JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews
- Economy of Permanence - J C Kumarappa
- Bharat Mein Angreji Raj - PanditSunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- India Wins Freedom - Maulana Abdul Kalam Azad
- Vivekananda - Romain Rolland (English)
- Gandhi - Romain Rolland (English)

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	-	-	-	-	-	-	-	3	-	1	-	1	-	-	-
CO.2	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-
CO.3	-	-	-	-	-	2	1	-	-	1	-	-	-	-	-
CO.4	-	-	-	-	-	2	2	-	-	1	-	1	-	-	-
CO.5	-	-	-	-	--	2	2	3	-	1	-	1	--	-	-
CO	-	-	-	-	-	2	2	3	-	1	-	1	-	-	-

V SEM

DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT51	3-0-0-0	3	50	50	3 hours	40

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 procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability, and durability.
4. Acquire knowledge in the analysis and design of RC elements.

Syllabus

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. Type of Loads on Structures and Load combinations- Code of practices and Specifications. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load, and strength. Stress block parameters, the 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. **(8 hours)**

Module – 2

Limit State Analysis of Beams:

Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear **(8 hours)**

Module – 3

Limit State Design of Beams: Design of singly reinforced beams with a check for shear, check for development length, and other checks. Design of doubly reinforced beams and flanged sections without checks **(8 hours)**

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. **(8 hours)**

Module – 5

Limit State Design 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. **(8 hours)**

Course Outcomes:

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 procedural knowledge in designs of RC structural elements such as slabs, columns, and footings.
4. Owns professional and ethical responsibility.

Text Books:

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. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

E-Resources

- **https://nptel.ac.in/courses/105105105**

POs & PSOs

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3										2	3	2
CO2	2	3		1									3	3	2
CO3	2	2	3	1									2	3	2
CO4	1					2		3					2	3	2
CO	1.75	2	3	1		2		3					2.25	3	2

GEOTECHNICAL ENGINEERING

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT52	2-2-0-0	3	50	50	3 hours	40

Prerequisites:

Concepts of Engineering Geology, Engineering Mechanics, and Stress Analysis.

Course Objectives:

The students will be able to understand the basic concepts of;

1. Soil mechanics to identify and classify the different soil types and comprehend basic engineering and mechanical properties of different types of soil.
2. In addition, they will study geotechnical engineering problems such as, the flow of water through soil medium and terminologies associated with geotechnical engineering and assess the improvement in mechanical behavior by densification of soil deposits using compaction.
3. Also, they will get to know about laboratory tests to determine the strength Characteristics of soils and consolidation settlement.

Syllabus

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 analysis). Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

(6L+2T)

Module – 2 **[8 hours]**

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 the 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, the effect of compaction on soil properties, Field compaction control- compaction effort & method of compaction, Proctor's needle, Compacting equipment's and their suitability.

(6L+2T)

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 and limitations.

Flow nets: Characteristics and applications. Flow nets for sheet piles and below the dam section. Effective stress and Neutral stress and impact of the effective stress in construction of structures, quicksand phenomena. **(6L+2T)**

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. Thixotropy 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. **(6L+2T)**

Module – 5 [

Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one-dimensional consolidation theory- assumptions and limitations. 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. Normally consolidated, under-consolidated, and over-consolidated soils. 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.

(6L+2T)

Course Outcomes:

Students will be able to

1. Acquire an understanding of the procedures to determine the index properties of soil, and classify the soil based on its index properties.
2. Determine compaction characteristics of soil and apply that knowledge to assess the field compaction.
3. Determine permeability of soils and acquire conceptual knowledge about stresses due to seepage and effective stress.
4. Estimate shear strength parameters of different types of soils by laboratory tests and comprehend with Mohr-Coulomb failure theory.
5. Estimate consolidation settlement of soil deposits and also the time required for the same.

Text Books:

1. Punmia B.C. , Ashok Kumar Jain, Arun Kumar Jain (2017), "Soil Mechanics and Foundation Engg.", 17th Edition, Laxmi Publications Co., New Delhi
2. Braja, M. Das (2017), "Principles of Geotechnical Engineering", Cengage India Private Limited; Ninth edition
3. Gopal Ranjan and Rao A.S.R. (2016), "Basic and Applied Soil Mechanics", 3rd edition, New Age International (P) Ltd., New Delhi

Reference Books:

1. BowlesJ.E., "Foundation Analysis and Design", McGrawHillPub.Co.NewYork.
2. SwamiSaran,"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. DonaldP.Coduto,"Geotechnical Engineering Principles & Practices", Prentice-hall of IndiaLtd, India.
5. Murthy VNS (2015)," Textbook of Soil Mechanics and Foundation Engineering:

Geotechnical Engineering series", CBS publishers

E-Resources

1. http://www.myopencourses.com/subject/e-book-on-concepts-andtechniques-in-geotechnical-andfoundation-engineering
2. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104Page1.htm
3. NPTEL:: Civil Engineering - NOC: Geotechnical Engineering - 1

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	2	3		1									3	2	2
C2	3	2		1									3	3	2
C3	3	2		1									3	2	2
C4	2	3	2	1									3	3	2
C5	2	3	1	1									3	2	2
C	2.4	2.6	1.5	1									3	2.4	2

TRANSPORTATION ENGINEERING (IC)						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
21CVI53	**2-2-2-0**	**04**	**50**	**50**	**3 hours**	**50hrs**

Prerequisites:

Basic knowledge regarding planning, design, construction, maintenance and operation of transportation facilities.

Course Objectives:

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 (engineering and financial aspects, regulations and policies, socio-economic impact).
3. Get insight into 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 highway economics by B/C, NPV, and IRR methods and also introduce the students to highway financing concepts

Module – 1

Introduction to Transportation Engineering: Importance of transportation, Different modes of transportation. Characteristics of road transport, Importance of Roads in India, Classification of Roads, Road Development plans, Programmes in India.

Highway Development and Planning: Highway Development in India, 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

(6L + 2T)

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 -Examples.

(6L + 2T)

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. Bituminous Binders & Mixes- Types, desirable properties. Pavement Quality Concrete- Materials, Requirements.

(6L + 2T)

Module – 4

Highway Drainage: Significance and requirements, Surface drainage system and Examples, subsurface 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,

(6L + 2T)

Module – 5

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

(6L + 2T)

PRACTICAL COMPONENT OF IC

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. Sieve analysis
b. CBR test

4. Tests on Bituminous Mixes

a. Marshall Method (Demo Experiment)

Course Outcomes:

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
5. Apply knowledge of various highway financing concepts.

Text Books:

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

Reference Books:

- C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi
- Relevant IRC Codes.

- Specifications for Roads and Bridges-MORTH, IRC, New Delhi.

E-Resources

- **https://nptel.ac.in/courses/105101087**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P10	P11	P12	PSO 1	PSO 2	PSO 3
CO1	1					2	1		2				1	2	
CO2	2	2													3
CO3	2	3													
CO4	2	2												2	
CO5	1	2													
C	**1**	**2.2**				**2**	**1**		**2**				**1**	**2**	**3**

CONCRETE TECHNOLOGY LABORATORY

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	Exam Duration	Total Lecture Hours
21CVL54	**0-0-2-0**	**1**	**50**	**50**	**3 hours**	**30**

Course Objectives:

The students will be able to:

1. Characterize cement properties by conducting various tests on cement.
2. To learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
3. To relate material characteristics to various applications of construction.

List of Experiments

Tests on Cement

1. Normal Consistency.
2. Setting Time.
3. The soundness of cement.
4. Specific Gravity.
5. Compressive Strength.

Tests on Concrete

Design of concrete mix as perIS-10262

Tests on fresh concrete:

i. Slump

ii. Compaction factor

iii. Vee Bee test.

Tests on hardened concrete:

i. Compressive strength test.

ii. Split tensile strength test.

iii. Flexural strength test.

NDT tests by Re-bound hammer and Ultra pulse velocity test.

Tests on Self-Compacting Concrete:

Design of self-compacting concrete, As per Is 10262:2019

a. slump flow test

b. U Box test

Course Outcomes:

Students will be able to

1. Determine the quality and suitability of cement.
2. Define the workability of fresh concrete.
3. Design appropriate concrete mix Using Professional codes.
4. Determine the strength and quality of concrete.
5. Evaluate the strength of structural elements using NDT techniques.

Text Books:

1. M.S Shetty, “Concrete Technology “, S. Chand & Co. Ltd, New Delhi.
2. Mehta P.K, “Properties of Concrete”, Tata McGraw Hill Publications, New Delhi.
3. M. L. Gambir, “Concrete Manual”, Danpat Rai and sons, New Delhi

Reference Books:

1. Neville AM, “Properties of Concrete”, ELBS Publications, London.
2. Relevant BIS codes.

E-Resources:

- http://elearning.vtu.ac.in
- www.sginstitute.in/downloads/civil.../manual_ConcreteTech

PO'S CO’S	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	2	1		3									2	3	2
C2	2	3		2									3	3	2
C3	1	1		2				3					2	3	2
C4	1	2	3										2	3	2
C5	1	1		2	3								3	3	2
C	1.4	1.6	3	1.8	3			3					2.4	3	2

ALTERNATE BUILDING MATERIALS & TECHNOLOGY

CourseCode	L-T-P-S (Hrs/ week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT551	3-0-0-0	3	50	50	3 hours	40

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.

Syllabus

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.

[8 hours]

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.

[8 hours]

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.

[8 hours]

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.

[8 hours]

Module – 5

Equipment for Production of Alternate Materials: Machines for manufacture of concrete, Equipment's 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.

[8 hours]

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 the energy efficient building by considering local climatic condition and building material.

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:

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.

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1				1						2	3	2
CO2	2	2	3	1									3	3	2
CO3	3	2	2	1									2	3	2
CO4	2	3		1									3	3	2
C	2.25	2.5	2	1			1						2.5	3	2

ANALYSIS OF INDETERMINATE STRUCTURE

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT552	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Strength of Materials, Structural Analysis 1.

Course Objectives:

The course will enable the students to analyze statically indeterminate structures from the knowledge of fundamental and basic concepts of structural analysis.

Syllabus

Module – 1

Moment Distribution Method: Introduction, Definition of terms- Distribution factor, Carryover factor, Development of method and Analysis of beams and orthogonal rigid jointed plane frames with kinematic redundancy less than/equal to three.

[8 hours]

Module – 2

Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway. Analysis of rigid jointed non-sway plane frames.

[8 hours]

Module – 3

Sway Analysis: Analysis of rigid jointed plane frames (sway, members assumed to be axially rigid) by moment distribution method.

[8 hours]

Module – 4

Matrix Method of Analysis (Flexibility Method): Introduction to matrix methods, types, local and global axis and coordinates, Derivation of flexibility matrix equation, Flexibility coefficient matrix. Analysis of continuous beams and rigid jointed plane frames with static indeterminacy up to 3 using system approach.

[8 hours]

Module – 5

Rolling Load and Influence Lines: Rolling load analysis for simply supported beams for several point loads and UDL, Influence line diagram for reaction, SF, and BM at a given section for the cases mentioned above.

[8 hours]

Course Outcomes:

Students will be able to

1. Develop relevant equations for the displacement method and apply the same for analysis of structures for different loading and boundary conditions.
2. Redistribute and estimate bending moments and shear force of Continuous beams and frame structures.
3. Develop conditions for the force method and apply the same for analysis on structures with different load and boundary conditions.
4. Analyze the beams and indeterminate frames by the system stiffness method.
5. Analyze beams for shear force and bending moment for rolling loads and use of influence line diagrams.

Text Books:

1. S S Bhavikatti: "Structural Analysis-Vol. II", (Chapters 1, 7, 8, and 12), Vikas Publishing House, 4th Edition, 2009, ISBN: 9788125927907.
2. S Ramamrutham and R Narayan: "Theory of Structures", (Chapters 1, 4, 6, 9), DhanpatRai Publishing Company Private Limited, New Delhi, 9thEdition, 2014, ISBN: 978-9384378103.

Reference Books:

1. V. N Vazirani: "Analysis of Structures Vol. 1: Analysis, Design and Details of Structures", (Chapters 1, 6, 9), International Student Edition, Mcgraw Hill Book Co., New York, 2008, ISBN: 978-8174091406.
2. Reddy C.S:"Basic Structural Analysis", (Chapters 1, 6, 8), Tata McGraw-Hill, New Delhi, 3rd Edition, 2010, ISBN: 9780070702769.

E-Resources

- http://elearning.vtu.ac.in/elcmys/13/enotes/eceem/gr.pdf
- http://elearning.vtu.ac.in/elcmys/e-con/stru_ana/ch5/html/0004.htm
- http://elearning.vtu.ac.in/elcmys/p2/cv42/Chapters_05/html/0004.htm
- http://elearning.vtu.ac.in/elcmys/struana.html

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1									1		2	2
CO2	3	3										1		2	2
CO3	3	3	1									1		2	2
CO4	3	3										1		2	2
CO5	3	3										1		2	2
C	**3**	**3**	**1**									**1**		**2**	**2**

AIR POLLUTION AND CONTROL

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT553	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Basic knowledge of the ambient atmosphere, atmospheric pollution, and different types of pollutants.

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.

Syllabus

Module – 1

Introduction: Composition and structure of the atmosphere. Air Pollution: Definition, Sources, classification, and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

[8 hours]

Module – 2

Meteorology: Temperature lapse rate & and atmospheric stability, wind velocity & and turbulence, plume behavior, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths, Numerical problems on effective stack height, and design of stack height.

[8 hours]

Module – 3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient), Monitoring and analysis of air pollutants (PM2.5, PM10, SO_x, NO_x, CO, NH_3). Development of air quality models-Gaussian dispersion model.

[8 hours]

Module – 4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, fabric filters & ESP.Control of gaseous pollutants – adsorption, absorption, combustion, and condensation.

[8 hours]

Module – 5

Air pollution due to automobiles, standards, and control methods. Indoor air pollution: sources, pollutants, effects, control. Noise pollution- causes, effects and control. Environmental issues, air pollution episodes. Environmental laws and acts.

[8 hours]

Course Outcomes:

1. Identify the major sources of air pollution and understand their effects on health and the environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and 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.
5. To identify automobile pollutants, environmental issues, standards and legislation.

Text 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.
3. Mackenzie Davis and David Cornwell, “Introduction to Environmental Engineering” McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, “Air Pollution Control Engineering”, Waveland Pr Inc.
2. Anjaneyulu Y, “Textbook of Air Pollution and Control Technologies”, Allied Publishers
3. Santosh Kumar Garg, Sewage disposal and air pollution Engineering, Khannapublisher, Vol. 2 39th edition 2018.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3					2	3	1						1	3
CO 2	3	3	2				3	1						2	3
CO 3	3	3	2	2			3	3						3	3
CO 4	3	3	3				3	3						3	3
CO5	**2**						**3**	**3**						**1**	**3**
C															

GEOGRAPHIC INFORMATION SYSTEM & PRACTICES

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT554	3-0-0-0	3	50	50	3 hours	40

Course Objectives:

The students will be learning:

- Introduce the students to the basic concepts of GIS and make the students familiar with the spatial data and spatial data creation and organisation.
- Teach various GIS based approaches and techniques to visualize and solve real life natural, environmental and societal problems.
- About GIS mapping and analysis Techniques.
- Spatial data analysis to solve natural, environmental and societal problems and challenges.

Syllabus

Module – I

Maps - Importance of maps to engineering projects, Types of maps, Scales and uses, Plotting accuracy, Map sheet numbering, Coordinate systems- Cartesian and geographical, map projections, map datum – MSL, Geoid, conical, spheroid, WGS-84.

[8 hours]

Module – II

Introduction to GIS: Definitions, history and evolution, place of GIS in Geoinformatics, Components of GIS, interdisciplinary relations, discrete geographic objects, Continuous geographic features, Vector and Raster Data structures, GIS application areas, careers in GIS. Spatial Data Types and Models: Spatial Data types, Non-spatial / Attribute Data types, Tessellations to represent geographic objects, Data models: Basic Data Models –raster and vector, Spaghetti model and Topological model, Advanced data models, raster and vector data formats.

[8 hours]

Module – III

Data Sources and Data Entry: Primary and secondary methods of acquisition of spatial and non-spatial data: surveying, remote sensing, Photogrammetry, Database creation, Data capturing, map scanning and digitizing, data exchange standards, topology building, editing and cleaning, linking of spatial and non-spatial data.

Data management- Algorithms, **DBMS, run-length encoding, quadtrees**, data overlay and modeling, data processing: raster based and vector based, data presentation –hardcopy devices, softcopy devices.

[8 hours]

Module – IV

Spatial Data Analysis and Integration: Spatial Measurements, Queries, various data models, Vector Data Analysis, Raster Data Analysis, Network Analysis, Terrain analysis, spatial analysis of 3-Dimensional data, Data integration and map overlay.

[8 hours]

Module – V

GNSS - Principle used, Components of GNSS, Data collection methods, DGPS, Errors in observations and corrections. DGPS and its applications. Commercially available GIS hardware and software, organization of data in GIS. Hands-on training in ArcGIS/ QGIS.

[8 hours]

Course Outcomes:

Students will be able to

1. Classify the maps, coordinate systems and projections
2. Analyse the basic components of GIS
3. Manage different types and Sources of Data in GIS with DBMS.
4. Process spatial, attribute data and prepare thematic maps.
5. Utilize GNSS and DGPS techniques for solving complex Problems.

Text Books:

1. Lo C P, Yeung A K W, Concepts and Techniques of Geographic Information Systems, Prentice Hall. India
2. Kang-tsung Chang, Introduction to Geographic Information Systems, Tata McGraw Hill
3. Burrough& McDonnell, Principles of Geographical Information Systems, 3rd Edition, Oxford University Press,2015.
4. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press 2008.

Reference Books:

1. Jan Van Sickle, GPS for land surveyors, Sleeping Bear Press, Michigan, 2001
2. Yang, Snyder &Tobler, Map projection Transformation principles and applications, CRC Press, 1999.
3. Kang – T surg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited 2015.
4. Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI,2006
5. M. Anji Reddy. Textbook Of Remote Sensing And Geographical Information Systems, 4th Edition BS Publications ISBN-10 9381075972.
6. Lilles and, Kiefer, Chipman,"Remote Sensing and Image Interpretation",Wiley 2011.
7. Chang, KT, Introduction to Geographic Information System, 8th Edition, McGraw Hill, 2016

8. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press2011.
9. John R. Jensen, "Remote sensing of the environment", an earth resources perspective–2nd edition– by Pearson Education 2007.

E-Resources:

IIRS(ISRO): https://elearning.iirs.gov.in

Esri MOOC's: https://www.esri.com/training/mooc/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		1							3			3
CO2		2			1							3		1	
CO3					1					3					3
CO4			1								3				3
CO5					1										3
CO	**3**	**2**	**1.5**		**1**					**3**	**3**	**3**		**1**	**3**

ENVIRONMENTAL STUDIES						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
21ENV56	**1-0-0-0**	**1**	**50**	**50**	**1 hours**	**10**

Course Objectives: To recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment. The industrial revolution and development have led to the stress on environment in the form of pollution. Checking of the pollution in all fronts at local and global level encompassing the issues of carbon credit, ozone level depletion, global warming, desertification and polar ice cap melting. The main objectives of the course is to expose to students to the problems and mitigation measures concerned to the environmental components like resources, air, water and land.

Syllabus

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. **2 Hours**

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. **2 Hours**

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. **2 Hours**

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. **2 Hours**

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; Visit to a local area to document environment assets river / forest / grassland / hill / mountain. Visit to a local polluted site-urban/rural/industrial/agricultural/Water Treatment Plant/ Waste water treatment Plant. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hills lopes; etc (field work equal to 2 lecture works) ought to be Followed by understanding of process and its brief documentation. **2 Hours**

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 abiotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Text Books:

- Benny Joseph: "Environmental Studies". Tata Mc Graw – Hill, 2nd Edition,2012.
- S M Prakash: "Environmental Studies", Pristine PublishingHouse, Mangalore, 3rd Edition,2018.
- R Rajagopalan: "Environmental Studies – From Crisis to Cure: Oxford Publisher, 2005.

Reference Books:

- Raman Sivakumar: "Principals of Environmental Science and Engineering", Cengage learning, Singapur, 2nd Edition,2005.
- M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007.
- Dr. B.S Chauhan, Environmental studies, university of science press 1st edition.

E-Resources

https://youtu.be/tqgo6PYfJLk?si=dd82TkdFKTu8D-zB

COs	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3		1				2
CO2						2		1				2
CO3						3		1				2
CO4						3		1				2
CO						2.75		1				2

APPLICATION OF AI IN CIVIL ENGINEERING

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21AEC57	1-0-2-0	2	20	100	3 hours	30

Prerequisites:

Basics of Python

Course Objectives:

1. To install the Python package and Iris data set
2. To understand supervised and unsupervised learning
3. To understand regression analysis

Syllabus

Module – 1

Introduction to sci-kit-learn Python package. Getting and processing data: CSV files, Panda's package, Feature selection, Online data sources. **(4L+2T)**

Module – 2

Data visualization using Matplot lib, Seaborn. Supervised and Unsupervised learning **(4L+2T)**

Module – 3

Regression: Simple linear regression, Multiple linear regression, Decision tree, Random forests **(4L+2T)**

Module – 4

Classification: Logistic regression, K-nearest neighbors, Decision tree classification, Random forests classification. Clustering: Goals and uses of clustering, K-means clustering. **(4L+2T)**

Module – 5

Artificial neural networks: Definition, Example, Potential and constraints **(4L+2T)**

Course Outcomes:

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

Text Books:

1. Peters Morgan, Data Analysis with Python, AI Sciences, 2016.
2. Wes McKinney, Python for Data Analysis, O'Reilly Media,

Reference Books:

- Automate the boring stuff in Python
- Python for beginners
- Gowrishankar

E-Resources

- Online study material
- Video lectures.
- NPTEL

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	1				2										
C2	3	3		2	2										
C3	3	3	1	2	2										
C	2.3	2		1.3	2										

QUALITY CONTROL AND QUALITY ASSURANCE

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21AEC58	1-0-0-0	1	50	50	1 hours	10

Prerequisites:

1. Material Testing.
2. Basic knowledge of Construction Management.
3. Building Materials and Concrete Technology.

Course Objectives:

This course will enable students to:

1. Understand the concept of Quality of materials used in Construction.
2. Implement the Quality control in construction.
3. Realize the importance of QMS in Civil Engineering.
4. Recommend QA/QC as per IS codes.
5. Evaluate on-site quality assessment of concrete.

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. **[2 hours]**

Module – 2

Quality Management: Management Practices: TQM, Vision and Quality policy, Quality Function Deployment, Benchmarking, and performance evaluation, ISO 9000 Quality Management System, ISO 14000 Environmental Management System. **[2 hours]**

Module – 3

Statistical Quality Control: Importance of SQC in construction, Statistical parameters: sampling, population and sampling, a measure of variability, a measure of central tendency, Recommendations of IS 456:2000 on sampling, testing and acceptance criteria for concrete. **[2 hours]**

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. **[2 hours]**

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. **[2 hours]**

Course Outcomes:

On completion of this course, students 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.
4. Determine on-site quality assessments of concrete.
5. Use relevant IS codes for QA/QC in construction materials.

Text Books:

1. Juran J M and Gryna F M, Quality Planning and Analysis Hutchins G, John L Ashford, The Management of Quality in Construction
2. Mohamed A. El-Reedy, "Concrete and Steel Construction, Quality Control and Assurance", CRC Press, Taylor, and Francis Group
3. Amitava Mitra, Fundamentals of Quality Control and Improvement, WILEY Publications, 4th Edition

Reference Books:

1. Abdul Razzak Rumane, Quality Management in Construction Projects, CRC Press, Taylor and Francis Group
2. M. S. Shetty, Concrete Technology, S Chand Publications
3. Relevant IS Codes

E-Resources

1. Online study material
2. YouTube videos

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			1								2	3	2
CO2	2	3		1	1								3	3	2
CO3	2	3		1	1	1							2	3	2
CO4	2	2	3			1							2	3	2
CO5	2	2				1		3					2	3	2
CO	2.2	2.4	3	1	1	1		3					2.2	3	2

VI SEM

CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT61	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Basic knowledge of construction planning

Course Objectives:

- Understand the fundamentals of construction and project management.
- Learn the fundamentals of Resource management
- Learn the elements of construction planning and scheduling
- Study the concepts of Construction economics
- Inculcate the concepts of entrepreneurship

Syllabus

Module – 1 **[8 hours]**

Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans

Construction Project Formulation: Introduction to construction management, Projects as a business; Fundamentals; Project management- concepts; Project management triangle; Project management systems; Project planning- scope definition, work breakdown structure; Organization breakdown structure; project organization, management functions, management styles, types of project plans, Grant Chart, bar chart.

Module – 2 **[8 hours]**

Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

Construction Equipment Management: Equipment-Selection, planning and financing, classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipment.

Materials Management: Importance, objectives and uses. Functions of materials management department and stores management

Module – 3 **[8 hours]**

CPM and PERT: Introduction to Critical Path Method (CPM), its applications, Network fundamentals, Numerical on Fulkerson's rule. Program Evaluation Review technique (PERT) and its uses and importance, Numerical on Time estimates.

Precedence Diagram Method (PDM) - four types of relationships and three types for lag, network design (PDM calculation) and analysis.

Module – 4 **[8 hours]**

Introduction to engineering economy: Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

Interest and time value : concept of simple and compound interest, interest formula for: single payment, equal payment and uniform series. Nominal and effective interest rates,

Comparison of alternatives: Present worth, annual equivalent , capitalized and rate of return methods , analysis.

Depreciation:Causes of Depreciation, Basic methods of computing depreciation charges, Exercises, Problems.

Module – 5 **[8 hours]**

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.

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.

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:

1. Gain insight on principles of construction project management
2. Apply knowledge on preparing project plans, schedule of construction, and project organization.
3. Formulate and solve problems on construction network and time estimates.
4. Evaluate alternatives and develop capital budget for different scenarios and apply the concepts of economics in constructions.
5. Gain knowledge of entrepreneurship

Text Books:

1. Chitkara K K, Construction Project Management, 10th Reprint, Tata McGraw Hill, 2006. ISBN-13: 978-9339205447.
2. Courtland A. Collier and William B. Ledbetter," Engineering Economics and Cost Analysis", Harper & Row.2005.ISBN-13: 9780673983947.
3. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.

Reference Books:

1. Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
2. S.C Sharma –"Construction Equipments and its management" – Khanna publishers
3. Srinath L.S, "PERT and CPM", 3rd Edition, East West Press Pvt. Ltd. New Delhi. 2001. ISBN-13: 978-8185336206
4. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
5. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, New Delhi
6. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant forbuilding works:
7. Riggs J.L., "Engineering Economy", 5th Edition, Tata McGraw Hill, ISBN 0-07-058670-5
8. R Panneerselvam "Engineering Economics", Eastern Economy Edition 2001, PHI, ISBN – 81- 203-1743-2

E-Resources

- https://nptel.ac.in/courses/110/107/110107081/

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3					1					3	1	2	2	
C2	3					1					3	1	2	2	
C3	3	3				1					3	1	2	2	
C4	3	3				1					3	1	2	2	
C5	3					1					3	1	2	2	
C	3	3				1					3	1	2	2	

GEOTECHNICAL ENGINEERING II

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT62	2-2-0-0	3	50	50	3 hours	40

Prerequisites:

Engineering Mechanics, Basics of Geotechnical Engineering, Stress Analysis.

Course Objectives:

The students will be able to learn;

1. Foundation engineering terminology and introductory concepts of Geotechnical investigations required for civil engineering projects.
2. Estimate the internal stresses developed in the soil mass and assess stability ofslopes and earth pressure on rigid retaining structures.
3. Different types of foundations and its bearing capacity determination along with settlement calculations.

Syllabus

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.

(6L+2T)

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).

(6L+2T)

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 Cullman'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, Taylor's stability number.

(6L+2T)

Module – 4 **[8 hours]**

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 eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.

(6L+2T)

Module – 5

Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static 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).

(6L+2T)

Course Outcomes:

Students will be able to

1. Plan and execute geotechnical site investigation program for different civil engineering projects.
2. Understand the stress distribution and resulting settlement beneath the loaded footings.
3. Estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures.
4. Determine bearing capacity of soil and also settlement beneath the loaded footings on sand and clayey soils.
5. Capable of estimating load carrying capacity of single and group of piles.

Text Books:

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

Reference Books:

1. Bowles J E , Foundation analysis and design, McGraw- Hill Publications, New York.
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. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.
5. Braja M. Das (2002), Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India.
6. P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.

E-Resources

- www.sciencedirect.com/science/book/9780124080768
- https://www.bauer.de>bma>info_80_e
- thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/
  • https:// www.nptel.ac.in/courses/105104034

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	2			1								2	3	3
C2	2	3	1									1	2	3	3
C3	2	3	2		1								3	3	2
C4	3	2	1										2	3	3
C5	2	3	1										2	3	3
C	2.4	2.6	1.25		1							1	2.2	3	2.8

DESIGN AND DRAWING OF STEEL STRUCTURES

CourseCode	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVI63	2-2-2-0	4	50	50	3 hours	50

Prerequisites:

Students should have knowledge of engineering mechanics this includes understanding statics, dynamics, mechanics of materials, and structural analysis.

Course Objectives:

This course enables the students to

1. Learn the Limit State Design concept and plastic behavior of structural steel members.
2. Analyze the behavior of different connections used in steel structures.
3. Understand the procedure of designing a steel structural tensile component.
4. Identify, formulate and solve engineering problems in Design of compression Members.
5. Design flexural members and column foundation bases.

Syllabus

Module – 1

Introduction: Structural systems. Mechanical properties of steel. Various uses of steel in civil engineering. Advantages and disadvantages of steel structures. various loads and their combinations. Design considerations, Limit state method of design, failure criterion of steel, codes of steel, rolled structural steel sections and specifications. Elastic modulus, Partial safety factors, load factor, working loads and ultimate loads.

Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic hinge concept, conditions of plastic analysis, Theorem of Plastic collapse and Plastic analysis of continuous beams. **10 Hours**

Module – 2

Bolted Connections: Introduction. Terms used in bolted connections. Types of bolted connections. Behavior of bolted joints, Design of axially loaded joints with ordinary black bolts and High strength Friction Grip (HSFG) bolts. Design of simple and moment resistant connections.

Welded Connections: Introduction, Welding process, Advantages of welding, Types and properties of welds, Types of welded joints, Weld specifications, Effective areas of welds, Design of welds, Design of Simple joints, Moment resistant connections (moment parallel and perpendicular to the plane of joint).

10 Hours

Module – 3

Design of Tension Members: Introduction, Types of tension members, lug angles (no design),slenderness ratio, behavior of axially loaded tension members, failure modes of tension members, Factors affecting the strength of tension members, Design of axially loaded tension members with bolted and welded connections. Designoftensionmember,Lugangles and Splices.

10 Hours.

Module – 4

Compression Members: Introduction, Behavior of compression members, rolled steel sections used for compression members. Effective length of compression members. Design of compression members using single section. Design of built up compression members with lacing.

Column Bases: Design of simple slab base and gusseted base. **10 Hours**

Module – 5

Design of beams: Introduction, sections used for beams, types of beams, factors affecting lateral stability and behavior of simple rolled steel beams in bending. Design of laterally supported and laterally unsupported rolled steel beams.

10 Hours

Laboratory Activities: Students have to draw the following structural elements using AUTO-CAD software.

Sl. No.	Name of the Activity
1	Bolted and welded connections.
2	Beam to Beam connections using bolted and welded.
3	Beam to column connections using bolted and welded.
4	Flexural members.
5	Detailed drawing of column bases such as slab base and gusseted base.

Course Outcomes:

1. Apply the concept of Limit State Design of steel structures.
2. Analyze and design steel structural beams subjected to plastic behavior.
3. Capable of design various steel components using bolted and welded connections and also to develop a Cad drawing for the fabrication of different components of structures.
4. Apply Indian Standard codal provisions for the design of tension and compression members.
5. Design flexural members and bases.

Text Books:

1. N Subramanian: "Design of Steel structures", Oxford University Press, 11th Edition, 2013, ISBN:9780195676815.
2. K S Duggal: "Limit State Design of Steel Structures", Tata Mcgraw Hill, Edition, 2010, ISBN:9781259083785.
3. S. Ramamrutham:"Design of Steel structures", Dhanpat Rai Publishing Company, Edition, 2018,ISBN-10: 8187433361; ISBN-13: 978-8187433361.

Reference Books:

1. S.S Bhavikatti: "Design of Steel Structures", IK International Pvt. Ltd.,2009, ISBN:9789380026619.
2. Dr. B C Punmia, Dr. A K Jain: "Comprehensive Design of Steel Structures", Firewall Media, 1998, ISBN:9788170080930.
3. P Dayaratnam "Design of Steel Structures", 2nd Edition, S Chand Publication,2012, ISBN-13: 978-8121923200.

E-Resources

- http://nptel.ac.in/courses/105106112/
- http://nptel.ac.in/courses/IITMADRAS/Design_Steel_Structures_I/index.php
- http://iitmweb.iitm.ac.in/phase2/courses/105103094/12

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	2	1	3							1			1	3	1
C2	1	1	3	3						1				3	2
C3	1	2	3							2				3	2
C4	1	2	3							2				3	3
C5	1	2	3							2				3	3
C	**1.2**	**1.6**	**3**							**1.6**				**3**	**2.2**

HYDRAULIC STRUCTURES

CourseCode	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT641	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

- **Fluid Mechanics**
- **Structural Mechanics**

Course Objectives:

1. Know and understand different types of Dams, Elements of dam section, utility and adaptability of various dams
2. To understand design principle of different types of dams and to design different types of dams
3. To understand miscellaneous types of dams, Spillways and their applicability
4. To know various types of dam failures and concept of stability

Syllabus

Module – 1 **[8 hours]**

Elements of Dam Engineering

Principles of Design of Hydraulic Structure, Selection of Type of Dam, Fixing Height of Dam, Investigation of Dam Sites.

Earth Dams : Seepage through Earth Dam-Location of Phreatic Line, Quantity of Seepage, Designof Filters, Seepage through Foundation-Control Measures Design of Earth Dam-Stability Computations with Earthquakes and Pore Pressure, Safety against Horizontal Shear

(6L+2T)

Module – 2 **[8 hours]**

Gravity Dams :

Stability analysis by gravity method, Method of Zoning – overflow and non- overflow sections, Internal stress analysis by wedge method and stability method.

Galleries in Dams : Stress concentration around openings Joints in Dams Treatments of Dam Foundations-Grouting Methods

(6L+2T)

Module – 3 **[8 hours]**

Arch Dams :

Suitability, Types, Design Methods, Cylinder Theory, Elastic Theory, Cain's Method, Shell Analysis, Trial Load Analysis, Selection of Arch Form

Buttress Dams : Types and Selection , Design Principles

Miscellaneous Types of Dams: Steel Dams, Timber Dams, etc.

(6L+2T)

Module – 4 **[8 hours]**

Dam outlet works

Spillways – Ogee spillway - cavitation's on spillway – design feature- design principles and design of spillways – Chute spillways –Energy dissipation – stilling basins – plunge pools

(6L+2T)

Module – 5 **[8 hours]**

Reservoir Outlets :

Outlet Gates, Spillway Gates, Design of Radial Gates, Forces on Gates,, Gate Control Equipment, River Intakes

(6L+2T)

Course Outcomes:

On the completion of the course one should be able to understand:

1. Choose suitable type of Dam and its sites for construction..
2. Locate phreatic line and carryout seepage and stability analysis of Embankment dam under various hydraulic conditions.
3. Calculate forces, stresses on gravity, arch and buttress dam. Also to check various factor of safety.
4. Explain and Design Ogee and Chute spillway.

Text Books:

1. Arora, K.R., Irrigation, Water Power and Water Resources Engineering, Standard Publishers Distributors, Delhi
2. Modi, P.N., Introduction To Water Resources And Waterpower Engineering, Standard Publication, Delhi
3. Garg, S.K., Irrigation Engineering and Hydraulic Structures Khanna Publishers
4. Asawa, G, L Irrigation And Water Resources Engineering, New Age Int. Ltd.

Reference Books:

1. Engineering for Dams Vol. I, II, III by Creager and Justin
2. Design of Small Dams; USBR
3. Earth and Earth-Rock Dam: Sherard and Woodward

E-Resources

1. http://nptel.iitm.ac.in/video.php?courseId=1029&v=XmO2pltg7YBz
2. http://nptel.iitm.ac.in/video.php?courseId=1029&v=SO0suW7TLiCs
3. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Water%20Resource%20Engg/New_index1.html
4. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l02.pdf
5. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l03.pdf
6. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l05.pdf
7. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l07.pdf

Note:

1. Experiments shall be performed in the field related to course contents.
2. The course includes a practical, where students have an opportunity to build an appreciation for the concept being taught in lecture

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	2	2	2		1									
C2	3	3	3	2		2									
C3	3	2	2	2		2									
C4	3	3	2	2		1									
C	3	2.5	2.25	2		1.5									

BRIDGE ENGINEERING						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**TotalHours**
21CVT642	**3--0-0**	**3**	**50**	**50**	**3 hours**	**40**

Course Objectives:

This course will enable students to:

- Formulate and solve engineering problems design of bridges.
- Know component sof bridge, Classification of Bridges, Survey and data collection for a bridge site selection.
- Design a system, component or process as per specifications
- To imbibe the culture of professional and ethical responsibilities by following codal provisions inthe analysis, design and detailing of bridges for strength and durability.

Syllabus

Module – 1

INTRODUCTION: 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.

(08 hours)

Module – 2

SPECIFICATIONS OF ROAD BRIDGES: Indian road Congress Bridge code, carriageway, clearance, Forces on bridge, Review of IRC loadings, applications of loads on bridge such as deadload, live load, impact effect etc.

(08 hours)

Module – 3

RC SLAB CULVERT: RC Slab culvert, dead load BM&SF ,BM & SF For IRC Class AA Tracked Vehicle ,BM & SFF or IRC Class AA Wheeled Vehicle, BM & SFF or IRC Class A Loading, Structural Design and drawing of Slab Culvert.

(08 hours)

Module – 4

Design Parameters: 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 BM &S F using IRC Class A A Tracked vehicle. Structural design and drawing of main Girder.

(08 hours)

Module – 5

SUB STRUCTURE: Definition of pier and abutment, Design and drawing of pier and abutments, Scour at abutments and pier, types of foundations, pile, well and pneumatic caissons.Importance of bridge bearings, sketches of different types of bearings.

(08 hours)

Course Outcomes:

Students will be able to

- Identify, formulate and do hydraulic design of bridges like afflux, scouring depth and calculate the most economical span among the given alternatives
- Identify different loadings coming on bridge structures in the form of DL, wind loads, earthquake loads and IRC 6 live loadings.
- Demonstrate the procedural knowledge to design a system, component or process asper needs and specifications of slab culvert subjected to various load combinations with different boundary conditions subjected to various load combinations with different boundary conditions.
- Demonstrate the procedural knowledge to design a system, component or process asper needs and specifications of T beam bridges subjected to various load combinations with different boundary conditions subjected to various load combinations with different boundary conditions.
- Will understand details of other important components of bridges like substructure, foundations, bearings joints and appurtenances.

Text Books:

- Essentials of Bridge Engineering by Dr D Johnson Victor, Oxford & IBHPublishing Co New Delhi
- Design of Bridges by Dr N Krishna Raju, Oxford & IBH Publishing Co New Delhi
- Design of Bridges by Jagadish and Dr M A Jayaram

Reference Books:

• Principles and Practice of Bridge Engineering by S P Bindra, Dhanpat Rai & Sons New Delhi
• IRC 6 – 2017 Standard Specifications And Code Of Practice For Road Bridges Section II Loadsand Stresses, The Indian Road Congress New Delhi
• IRC 112 -2019 Standard Specifications And Code Of Practice For Road Bridges Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
• IS 456 - 2000 Indian Standard Plain and Reinforced Concrete Code of Practice (Fourth Revision)BIS New Delhi
• IS 1343 - 2019 Indian Standard Prestressed Concrete Code of Practice BIS New Delhi.

E-Resources - https://archive.nptel.ac.in/courses/105/105/105105165/

POs & PSOs

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	2				2						2		3	
C2	3	2				1						2		3	
C3	3			1								1		3	
C4	3	2										2		3	
C5	2	2	3			1						1		3	
CO	2.5	2	3	1		1.33						1.67		3	

GROUNDWATER HYDROLOGY

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT643	2-2-0-0	3	50	50	3 hours	40

Course Objectives:

The students will be learning:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Syllabus

Module – I

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

08 Hrs

Module – II

Fundamentals of Groundwater 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, steady one dimensional flow: cases with recharge.

08 Hrs

Module – III

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, leaky aquifers (only introduction), interference of well, image well theory.

08 Hrs

Module – IV

Ground Water Exploration: Seismic method, electrical resistivity method, Geophysical techniques, electrical logging, radioactive logging, induction logging, sonic, and fluid logging.

08 Hrs

Module – V

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.

Groundwater Recharge: Artificial recharge, groundwater runoff.

08 Hrs

Course Outcomes: 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 groundwater resources.
4. Select a particular type of well and augment the ground water storage.
5. Able to develop techniques for sustainable water management

Text Books:

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. Garg Satya Prakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.

E-Resources:

1. https://nptel.ac.in/courses/105103026
2. https://www.un-igrac.org/news/free-online-course-groundwater-resources-management

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2												1	3
CO2			3	1			2							1	
CO3				1	3		3							3	
CO4						3							3	3	
CO5			**1**			**2**	**1**						**1**	**2**	
CO	**2**	**2**	**2**	**1**	**3**	**2.5**	**1**						**2**	**2**	**3**

REMOTE SENSING AND PHOTOGRAMMETRY

CourseCode	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
22CVT644	2-2-0-0	3	50	50	3 hours	40

Course Objectives:

The students will be learning:

1. The principles of remote sensing and spectral signatures.
2. Satellites and types of Sensors used for Remote Sensing,
3. Photogrammetry and UAV's Techniques.
4. Enhancement and information extraction and digital image processing.
5. Application of RS is in various domains including Watershed management, Irrigation management, Drought and Flood monitoring, Environment and ecology.

Syllabus

Module – I

Principles of Remote Sensing: Introduction to remote sensing & system. Electromagnetic spectrum, Black body radiation, Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system, Radiation interaction with the Earth surface, Active & Passive Microwave Remote Sensing: Basics–physics of RADAR waves, spectral characteristics of RADAR waves, microwave radiometers, Hyper spectral remote sensing. Spectral reflectance curve

8 Hrs

Module – II

Platforms, Sensors and Data Products: Introduction - Ground aircraft, space aircraft platforms-photographic sensors, scanners, radiometers, and Mission planning. Data types and format, Scale and Legend., platforms- Indian satellite IRS and Landsat specifications, Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal) **Synthetic Aperture Radar, InSAR, DInSAR, TOMSAR, UWBSAR, DFSAR, PolSAR. Data products- Single Look Complex (SLC), Ground Range Detected (GRD), Acquisition modes.**

8 Hrs

Module – III

Aerial Photogrammetry - Types of photographs, Flying height and scale, Relief (height) displacement, Stereoscopy, 3-D Model, Height determination using Parallax Bar, Digital Elevation Model (DEM), Slope, Exaggeration. **Unmanned Aerial Vehicles (UAV) Drone Surveying.**

08 Hrs

Module – IV

Basic elements in Image interpretation Visual and digital interpretation methods. Digital Image Processing - Digital image characteristics: image histogram and scattergram and their significance, Variance-Covariance matrix, Correlation matrix and their significance. Radiometric and Geometric Corrections – Registration and Resampling techniques.

Image Enhancement – Contrast Enhancement: Linear and Non-linear methods; Spatial Enhancement: Noise and Spatial filters Image Transformation – Principal Component Analysis (PCA), Discriminant Analysis, Color transformations (RGB - IHS, CMYK), Indices (Ratios, NDVI, NDWI). Image Segmentation and Classification – Simple techniques. SAR image processing,

08 Hrs

Module – V

Applications of RS in Civil Engineering: Water resource management, Ground water Application, Agriculture, Earthquake hazardous, Urban Development Planning, Flood monitoring using SAR, Drought monitoring, Transportation engineering, Watershed management, Irrigation management, Site selection for Dams, Bridges and Reservoirs.

08 Hrs

Course Outcomes: Students will be able to

1. Demonstrate the concepts of Electromagnetic energy, spectrum and spectral signature curves.
2. Apply the concepts of satellite and sensor parameters and characteristics of different platforms.
3. Understand the concept of Photogrammetry.
4. Process the remote sensing images.
5. Solve complex Civil Engineering Problems using Remote Sensing techniques.

Text Books:

1. Lilles and T. M and R. W. Kiefer:"Remote Sensing and Image Interpretation",(Chapters 1-8), 4thEdition, John Wiley and Sons, 2000, ISBN: 9780470052457.
2. Jensen J.R: "Introductory digital image processing, a remote sensing perspec-tive",(Chapters 1-4),2nd Edition Prentice Hall,1996, ISBN:9780132058407.
3. Anil Kumar Jain. Fundamentals of digital image processing Prentice-Hall of India Pvt. Ltd ISBN · 9788120309296, 9788120309296.
4. M. Anji Reddy., Textbook Of Remote Sensing And Geographical Information Systems, 4th Edition BS Publications ISBN-10 9381075972

Reference Books:

1. Ravi P Gupta: "Remote Sensing Geology", (Chapters 1-8), Springer Verilag, New York, ISBN: 9783662052839
2. Mather P.M.: "Computer Processing of Remotely-Sensed Images, an introduction", ISBN: 9781119956419.
3. Richards J.A.,andX.Jia:"Remote Sensing Digital Image Analysis: An introduction",(Chapters 1-3), 3 rd Edition, Springer, 2006, ISBN: 9783540297116.
4. MikhailE.,J.Bethel,and J.C.McGlone:"Introduction to modern photogrammetry",(Chapters 5-9),Wiley,2001, ISBN:9780471309246.
5. Rafael C. Gonzalez., Digital Image Processing, 4 edition, Pearson Education ISBN-10-9353062985.
6. S. Jayaram, Veerakumar T, Esakkirajan S., Digital Image Processing, McGraw Hill Education, ISBN-10-0070144796

E-Resources:

IIRS(ISRO): https://elearning.iirs.gov.in
Esri MOOC's: https://www.esri.com/training/mooc/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1												1		3
CO2					1					3					3
CO3					1										3
CO4					1										3
CO5			1		1								1	1	3

GEOTECHNICAL LABORATORY

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVL65	0-0-2-0	1	50	50	3 hours	20

Prerequisites:

Engineering Mechanics, Basics of Geotechnical Engineering, Material Testing.

Course Objectives:

The students will be able to:

1. Determine the index properties to classify the soil.
2. Evaluation of the compaction characteristics of soils
3. Analyze the flow water through soil
4. Estimate shear strength parameters and consolidation characteristics of soil.

Syllabus

LIST OF EXPERIMENTS

Conducted in Laboratory:

1. Determination of the water content of soil by oven drying method
2. Determination of the specific gravity of soil by pycnometer and density bottle method
3. Determination of the particle size distribution of coarse grained soil sample by dry sieve analysis.
4. Determination of the in situ density of soil by core cutter and sand replacement methods
5. Determination of liquid limit plastic limit and shrinkage limit of soil specimen
6. Determination of the compaction characteristics of soil by Standard Proctor test and Modified Proctor test.
7. Determination of the permeability of soil specimen by constant head and variable head methods
8. Determination of the shear parameters of a sandy soil by direct shear test
9. Determination of the unconfined compressive strength of cohesive soil.
10. Determination of the shear strength parameters of soil from unconsolidated undrained (UU) triaxial test.

Demonstration:

1. Field Identification of soil, gravel type, sand type, silt type and clay types soils.
2. Demonstration of determination of the particle size distribution of fine grained soil sample by hydrometer method
3. Demonstration of the consolidation characteristics of soil sample.
4. Demonstration of relative density of cohesionless soil
5. Demonstration of miscellaneous equipment's such as Augers, Samplers, Rapid Moisture meter, Proctor's needle.
6. Demonstration of determination of the shear strength of very soft soil specimen by laboratory vane shear test.

Course Outcomes:

Students will be able to

1. Classify the soil based on index properties of soil.
2. Examine the compaction characteristics of soil to control compaction in the field.
3. Evaluate the coefficient of permeability of soil.
4. Determine the shear strength parameter and consolidation characteristics of soil and Use the results for solution of engineering problem.

Text Books:

1. Soil Mechanics and Foundation Engg.- Punmia B.C.(2005), 16th Edition Laxmi Publications Co., New Delhi.
2. Dr. K.R.Arora, "Soil Mechanics & Foundation Engineering", Standard Publishers &Distributors, New Delhi. Ltd., Second Edition, 1984.
3. Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol.I, II, III, Princeton Press, London.

Reference Books:

1. Soil Testing for Engineers- Lambe T.W., Wiley Eastern Ltd., New Delhi.
2. Engineering Properties of Soil and Their Measurements- Bowles J.E. (1988), - McGraw Hill Book Co. New York.
3. BIS Codes of Practice: IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part– 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) –1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) –1966, IS 2720 (Part-60) 1965.

E-Resources

1. https://nptel.ac.in/courses/105/101/105101160/
2. https://www.slideshare.net/RambabuPalaka/gt-lab-manual
3. https://nptel.ac.in/courses/105/101/105101201/

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3	3	1			2			3	3			2	3	
C2	2	3	1			1			3	3			2	3	
C3	2	3	1			1			3	3			2	3	
C4	2	3	1			2			3	3			2	3	
C	**2.8**	**3**	**1**			**1.5**			**3**	**3**			**2**	**3**	

INTELLIGENT TRANSPORT SYSTEM

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT661	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Course Objectives:

This course will enable students to

1. Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control.
2. 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.

Syllabus

Module – 1 **[8 hours]**

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 **(6L+2T)**

Module – 2 **[8 hours]**

Advanced traveler information systems; transportation network operations; commercial vehicle operations and intermodal freight. **(6L+2T)**

Module – 3 **[8 hours]**

Public transportation applications, ITS, and regional strategic transportation planning, including regional, architectures. **(6L+2T)**

Module–4 **[8 hours]**

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. **(6L+2T)**

Module – 5 **[8 hours]**

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. **(6L+2T)**

Course Outcomes:

1. After studying this course, students would be able to suggest the appropriate system/s in various functional areas of transportation.
2. Would be able to amalgamate the various systems, and plan and implement the applications of ITS.

3. Would have learned the application of information technology and telecommunication to control traffic and provide advanced information to travelers, automatically handling emergencies and improving safety.

Text Books:

- Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation SystemsPlanning" Artech House.
- 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.

Reference Books:

- Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005.
- US Department of Transportation, "National ITS Architecture Documentation", 2007(CDROM).
- Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems"

E-Resources

- **https://nptel.ac.in/courses/105107210**
- **https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html**

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	2		2	2		1	1	1		1	1	1			
C2	2	3	2	1	1	1	1	1		1	1	1	2	1	1
C3	2		2	1	2	1	1	1		1	1	1			
C	**2**	**1**	**2**	**1.3**	**1**	**1**	**1**	**1**		**1**	**1**	**1**	**0.6**	**0.3**	**0.3**

ENVIRONMENTAL PROTECTION AND MANAGEMENT						
CourseCode	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
21CVT662	**3-0-0-0**	**3**	**50**	**50**	**3 hours**	**40**

Prerequisites:

Basic knowledge on sustainability and different types of pollution.

Course Objectives:

- Understand environmental management system (EMS) definitions, concepts, guidelines and requirements of the ISO 14001 standard.
- Know the various stages of EMS implementation, learn best practice techniques, apply environmental management principles to achieve continual improvement in an organization.
- Provide a basic understanding of various tools and techniques such life cycle assessment, environmental audits, evaluation of environmental performance for environmental decision-making

Syllabus

Module – 1 **[8 hours]**

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. **(6L+2T)**

Module – 2 **[8 hours]**

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. **(6L+2T)**

Module – 3 **[8 hours]**

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. **(6L+2T)**

Module – 4 **[8 hours]**

Environmental Audit:

Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Nonconformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit. **(6L+2T)**

Module – 5 **[8 hours]**

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, Tran's boundary movement, disposal. **(6L+2T)**

Course Outcomes:

- Acquainted with the environmental management system and its benefits
- Appreciate the elements of Corporate Environmental Management systems complying with international environmental management system standards.
- Evaluate the effectiveness of systematic EMS monitoring processes.
- Lead pollution prevention assessment team and implement waste minimization options.
- Develop, Implement, maintain and Audit Environmental Management systems for Organizations.

Text Books:

- Vivian Baldwin: "Environmental Protection and Management". Murphy & Moore, 2022, ISBN: 1639871969, 9781639871964.
- Mary K. Theodore, Louis Theodore: "Introduction to Environmental Management", CRC press, Taylor and Francis group, 2021, ISBN 9780367758103.
- Bala Krishnamoorthy: "Environmental Management: Text and Cases", PHI (2017), ISBN: 9788120353428.

Reference Books:

- ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organization for Standardization, 2004.
- ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002.
- Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.
- Paul L Bishop „Pollution Prevention: Fundamentals and Practice, McGraw- Hill International, Boston, 2000.

E-Resources

- https://youtube.com/playlist?list=PLwdnzlV3ogoV162m7Q1rCQamsvKWT9D08&si=omUrRz6e63X6tecl.

COs	**POs**											
CO1						2						2
CO2						2		2				2
CO3						2	1					2
CO4						2	3					2
CO5						**2**	**2**					**2**
CO						**2**	**2**	**2**				**2**

ENERGY EFFICIENCY IN GREEN BUILDINGS

CourseCode	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT663	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Basic knowledge on sustainability.

Course Objectives:

- Impart knowledge of the principles and practices of the green buildings.
- Know the importance of sustainable use of natural resources and energy.
- Understand the principles of effective energy and resources management in buildings.
- Bring awareness of the basic criteria in the green building rating systems.
- Understand the methodologies to reduce, recycle and reuse towards sustainability.

Syllabus

Module – 1 **[8 hours]**

Introduction to Green Buildings:

Definition of green buildings, definition of sustainability, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems. **(6L+2T)**

Module – 2 **[8 hours]**

Site selection and planning:

Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, and so on. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems. **(6L+2T)**

Module – 3 **[8 hours]**

Energy Efficiency:

Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, Solar Heat Gain Coefficient, U-Values for facade materials, efficient lighting technologies, energy efficient and BEE rated appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of NET ZERO buildings. **(6L+2T)**

Module – 4 **[8 hours]**

Building materials:

Methods to reduce embodied energy in building materials: (a) Local building materials. (b) Natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks. (c) Materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) Reuse of waste and salvaged materials. Waste Management: Handling of construction & demolition waste materials, separation of household waste, handling e-waste, on-site and off-site organic waste management. **(6L+2T)**

Module – 5 **[8 hours]**

Indoor Environmental Quality:

Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment. **(6L+2T)**

Course Outcomes:

- Define sustainability and a green building, along with its features and benefits.
- Describe the criteria used for site selection and water efficiency methods.
- Explain the energy efficiency terms and methods used in green building practices.
- Select materials for sustainable built environment & adopt waste management methods.
- Describe the methods used to maintain indoor environmental quality.

Text Books:

- HarharaIyer G, Green Building Fundamentals, Notion Press.
- Dr. Adv. Harshul Savla, Green Building: Principles & Practices.
- D. A. Vallero and C. Brasier: "The Science of Sustainability and Green Engineering". Willy, John willey and sons, Inc.
- K. S. Jagadish, "Alternative Building Materials and Technologies",New age international publishers.

Reference Books:

- IGBC Green Homes Rating System, Version 2.0, Abridged reference guide, 2013, Indian Green Building Council Publishers.
- GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
- Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
- Non-Conventional Energy Resource by G. D. Rai, Khanna Publishers.
- Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi, 2004.
- Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010. 7. Charles J. Kibert, Sustainable Construction - Green Building Design and Delivery, John Wiley & Sons, New York, 2008.
- Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009

E-Resources

- https://youtube.com/playlist?list=PLwdnzlV3ogoV162m7Q1rCQamsvKWT9D08&si=omUrRz6e63X6tecl.

COs	POs											
CO1							3					2
CO2						2						2
CO3						2	3					2
CO4						2	3					2
CO5						**2**						**2**

RAILWAYS AND AIRPORT ENGINEERING

CourseCode	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT664	3-0-0-0	03	50	50	3 hours	40hrs

Prerequisites:

Basic knowledge about the role of railways, planning, properties of materials, airport features and facilities knowledge about harbors and tunnel Engineering**.**

Course Objectives:

1. Understand the history and development, role of railways, railway planning and development based on essential criteria.
2. Learn different types of structural components, engineering properties of the materials,to calculate the material 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.

Syllabus

Module – 1 **[8 hours]**

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, superelevation, widening of gauge on curves- Points and Crossings

Module – 2 **[8 hours]**

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 **[8 hours]**

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 **[8 hours]**

Airport Planning: Air transport characteristics, airport classification, airport planning: objectives, c o m p o n e n t s , 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 **[8 hours]**

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 Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

Course Outcomes:

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

1. Identify the importance of Railway Engineering in transportation sector.
2. Analyze the components of Airport design.sign the various Geometrics of railways
3. Demonstrate the different types of tunnels and methods of tunneling.
4. Identify the importance of Harbour and dock construction.

Text Books:

1. 1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. 2. Satish Chandra and Agarwal M. M,"Railway Engineering", 2nd Edition, Oxford University Press ,New Delhi.
3. 3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemch and and Brothers, Roorkee.

Reference Books:

1. CVenkatramaiah, "Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press.
2. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.

E-Resources

- **https://nptel.ac.in/courses/105107123**

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	1			2		2	2		2				1		
C2			2	2										2	
C3						1	2								
C4	2												1		
C	**1.5**		**2**	**2**		**1.5**	**2**		**2**				**1**	**2**	

MINI PROJECT

CourseCode	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total LectureHours
21CVT67	0-0-3-3	3	50	50	3 hours	40

Course objectives:

1. To support independent learning and innovative attitude.
2. To guide to select and utilize adequate information from varied resources upholding ethics.
3. To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
4. To develop interactive, communication, organisation, time management, and presentation skills.
5. To impart flexibility and adaptability.
6. To inspire independent and team working.
7. To expand intellectual capacity, credibility, judgement, intuition.
8. To adhere to punctuality, setting and meeting deadlines.
9. To instill responsibilities to oneself and others.
10. 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

Mini-Project: 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.

Mini-project work:

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 senior faculty members of the Department, one of whom shall be 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 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 college.

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.

SEE for Mini-project:

(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the Mini-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.

Course outcomes:

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

1. Present the mini-project and be able to defend it.
2. Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
3. Habituated to critical thinking and use problem solving skills.
4. Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
5. Work in a team to achieve common goal.
6. Learn on their own, reflect on their learning and take appropriate actions to improve it.

INTERNSHIP						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total LectureHours**
21CVT68	**0-0-3-3**	**3**	**50**	**50**	**3 hours**	**40**

Course Learning Objectives:-

This course will enable students to get the field exposure and experience.

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.

VII SEM

ESTIMATION, COSTING AND VALUATION

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT71	2-2-0-0	3	50	50	3 hours	40

Prerequisites:

- Engineering Mathematics.
- Construction Materials and Concrete Technology

Course Objectives:

This course will enable students to:

- Gain the knowledge of estimating the different types of buildings.
- Estimate the quantities of work and develop the bill of quantities and arrive at the Cost of Civil Engineering Project.
- Identify the specifications of different items of works
- Analyse the rates of different building components of works according to standard schedule of rates.
- Understand, Apply and Create the Tender and Contract document

Syllabus

Module – 1

Introduction: Introduction to estimating, types of estimation, different item of works, Unit of measurements, Method of taking quantities - Study of the various drawings.

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, color washing and painting / varnishing for shops, rooms, residential, building.

(6L+2T)

Module – 2

Estimate of joineries -for paneled and glazed doors, windows, ventilators, handrails etc.

Estimation of sanitary - septic tank and manhole – water supply pipeline – sewer line,

Estimation of road works- bituminous and cement concrete roads

(6L+2T)

Module – 3

Specifications & Analysis of rates: Data, Schedule of rates, Analysis of rates – Specifications – sources – Detailed and general specifications, M-Book Measurement - Preparation of bills – Preparation of BOQ (Bill of Quantity)**.** Self study: Excel sheets preparation

(6L+2T)

Module – 4

Valuation: Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease Arbitration and legal requirements.

(6L+2T)

Module – 5

Contract Management: Types of contract- essentials of contract agreement- legal aspects, penal provisions on breach of contract. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Law of Contract as per Indian Contract act 1872, Joint venture.

Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Features / elements of the standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC)

(6L+2T)

Course Outcomes:

Students will be able to

- Estimation of quantities and cost of the projects.
- Analyze the rates and write specifications of individual items for the preparation of the estimates.
- Valuate and fix rent for existing buildings as per legal requirements.
- Assess contract and tender documents for various construction works.

Text Books:

- B.N. Dutta : "Estimating and costing", UBS publishers Distributors Ltd.,India,27th Edition, ISBN-13:978-8174767295.
- P. L. Basin:"Quantity Surveying",3rd Revised Edition, S. Chandand company, New Delhi, ISBN-10:8121900859.
- S.C. Rangwala: "Estimating and Specification", 16th Edition, Charotar publishing house, 2014, ISBN:978-93-80358-97-0.

Reference Books:

- G.S. Birde: "Text book of Estimating and Costing", 6th Edition, Dhanpath Rai and sons, New Delhi, ISBN:9789384378134.
- D.D. Kohli, R.C. Kohli: "A textbook on Estimating, Costing and Accounts", 2ndEdition, S. Chand, New Delhi, ISBN-10:8121903327.
- Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.

E-Resources

- https://www.schandpublishing.com/books/...textbook-estimating-costing.
- nfra.eresourceerp.com/estimation.html
- nfra.eresourceerp.com/Project-estimation.html
- https://www.mynewsdesk.com/in/view/pressrelease/job-costing-estimation

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1										2	3	2
CO3	2	3											2	3	2
CO4	2	1						3					3	3	2
CO5	2	3											2	3	2
CO	2.0	2.5	1					3					2.25	3	2

PRESTRESSED CONCRETE

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVT72	2-1-0-0	2	50	50	3 hours	30 hours

Prerequisites:

Knowledge of engineering mechanics, Building materials and Design of reinforced concrete structures.

Course Objectives:

This course will enable students

- Understand the concept of pre-stressing, devices for pre and post-tensioning.
- Identify different stress distribution due to pre-stress and the imposed load.
- Calculate loss of pre-stress and deflection in PSC members.
- Study the limit state of PSC beams in flexure and shear, anchorage zone (End block) stress.

Syllabus

Module – 1

Introduction: Definition and scope of pre-stressed concrete, its applications, Types of pre-stressing system, High strength concrete and steel, Stress-Strain characteristics and properties.

Basic Principles of Pre-stressing: Fundamentals, load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning devices, tensioning methods and end anchorages.

(5hours)

Module – 2

Analysis of Sections for Flexure: Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles. (problems on stress concept)

(4 hours)

Module – 3

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. (problems on Losses **)**

Deflections: Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer of loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep and deflection, load verses deflection curve, methods of reducing deflection.

(8hours)

Module – 4

Design of beam: Flexure -IS Code recommendations –Ultimate flexural strength of sections Shear, shear resistance of sections, shear reinforcement. Limit state of serviceability control of deflections and cracking. Design of pre-tensioned and post-tensioned sections. **(8 hours)**

Module – 5

Anchorage system - Transmission of pre-stress in pre-tensioned member, transmission length, anchorage stress in post-tensioned members. Bearing stress and bursting tensile force, stresses in end block, IS code method, design of anchorage zone reinforcement. **(5 hours)**

Course Outcomes:

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

- Identify different pre-stressing techniques and apply principles of pre-stressing to field problem.

- Evaluate the nature of stresses in the flexural member.
- Evaluate the different losses in PSC members.
- Compute the deflection of PSC members
- Design the pre-tensioned and post-tensioned beams.

Text Books:

- Krishna Raju, N. "Pre stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006
- Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
- 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
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

E-Resources

- https://nptel.ac.in/courses/105106117.
- https://archive.nptel.ac.in/courses/105/106/105106118/.
- https://www.scribd.com/document/359069931/Prestress-Notes-NPTEL-10

PO'S / CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C1	3											1		3	
C2	3	2										2		3	
C3	3	3										1		3	
C4	3	3	3									1		3	
C5	3	3	3									2		3	
CO	**3**	**2.75**	**3**									**1.4**		**3**	

ADVANCED FOUNDATION ENGINEERING

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Hours
21CVP731	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Basic concepts of physics and mathematics. Analysis of forces systems with different structures.

Course Objectives:

Course objectives: This course will enable students

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. Analyze when the soil anchors are to be provided

Syllabus

Module – 1

Foundation design basics: Criteria for choice of foundation, bearing capacity, total and differential settlements, tolerance for various types of structures, Interpretation of soil profile from design parameters like modulus of compressibility, Modulus of subgrade reaction, Poisson's ratio, etc.

(08 hours)

Module – 2

Design of Shallow Foundation: Design of foundation in sloping grounds,

Raft foundations: Raft foundations for building and tower structures, including effects of soil-structure interaction and nonlinearity, different types of rafts.

(08 hours)

Module – 3

Deep Foundations: Pile foundation-types, methods of installation, codal practices for permissible load under vertical and lateral loads, stresses during pile driving, load carrying capacity of pile groups, negative skin friction and under-reamed piles.

Soil Anchors: Inclusions and Installation Techniques, Design of Soil Anchors, Application Criteria: Advantages and Limitations

[08 hours]

Module – 4

Cantilever Sheet Piles and Anchored Bulkheads: Earth pressure diagram, determination of depth of embedment in sands and clays, timbering of trenches, Earth pressure diagrams, forces in struts. Design of anchored piles

[08 hours]

Module – 5

Foundation for Heavy structures, well foundations, caisson foundations, equipment used for construction of these foundation system

Cofferdams: Stability, bearing capacity, settlements (qualitative treatment only, no designs).

[08 hours]

Course Outcomes: An ability to

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

CO1: Identify a suitable foundation system for a structure.
CO2: Evaluate the importance of raft foundation and principles of design for buildings and tower structures.
CO3: Analyse and design pile foundations.
CO4: Understand the basics of analysis and design principles of well foundation, drilled piers and caissons..

Text Books:

- Das, B.M., "Principles of Foundation Engineering", 4th Edition, PWS Publishing, Singapore, 1999
- Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw- Hill International, 2000
- Shamsher Prakash, "Soil Dynamics", 3 rd Edition, John Wiley publications, 2000.

Reference Books:

- Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", 4 th Edition ,Sai Krupa Technical Consultants, 2000
- Venkataramah, C., "Geotechnical Engineering", 5th Edition, New Age International Pvt. Ltd., 2009
- Swami Saran, "Analysis and Design of Substructures", 2nd Edition, Oxford & IBH Publishing Company Pvt. Ltd., 2009.
- Gopal Ranjan & ASR Rao, "Basic and Applied Soil Mechanics", 3 rd Edition, New Age International Pvt. Ltd, Publishers, 2002.

E-Resources

- https://easyengineering.net/advanced-foundation-engineering-book/
- https://civiltechnicalguruji.files.wordpress.com/2018/07/advanced-foundation-engineering.pdf
- https://nitsri.ac.in/Department/Civil%20Engineering/CGE-202_7_Pile_Foundation_Design__A_Student_Guide.pdf

Online Courses and Video Lectures

- https://onlinecourses.nptel.ac.in/noc22_ce32/preview
- https://www.online.vtu.ac.in/course-details/Advanced-Foundation-Engineering
- https://pragya.gmrgroup.in/courses/course-v1:GMRXNPTEL+AFE001+2021_T3/about

POs & PSOs

PO'S / CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C1	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
C2	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
C3	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
C4	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-
CO	3	3	-	-	1	2	-	1	-	-	-	3	3	3	-

TRAFFIC ENGINEERING AND MANAGEMENT						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
21CVP732	**3-0-0-0**	**3**	**20**	**100**	**3 hours**	**40**

Prerequisites:

Basic Knowledge of Roads, Airways, Railways, and transportation Engineering.

Course Objectives:

- Understand fundamental knowledge of traffic engineering, its 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 to analyze traffic flow situations and emphasize the interaction of flow efficiency and traffic safety.
- Understand and analyze traffic issues including safety, planning, design, operation, and control.
- Apply intelligent transport systems and their applications in the present traffic scenario

Syllabus

Module – 1 **[8 hours]**

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. **(6L+2T)**

Module – 2 **[8 hours]**

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**.** **(6L+2T)**

Module – 3 **[8 hours]**

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. **(6L+2T)**

Module – 4 **[8 hours]**

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. **(6L+2T)**

Module – 5 **[8 hours]**

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

(6L+2T)

Course Outcomes:

At the end of the course, the student will be able to:

- Understand the human factors and vehicular factors in traffic engineering design.
- Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
- Use an appropriate traffic flow theory and to comprehend the capacity & signalized inter-section analysis.
- Understand the basic knowledge of Intelligent Transportation Systems.

Text Books:

- Kadiyali. L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi,2013
- S K Khanna and CEG Justo and A. Veeraragavan, "Highway Engineering", Nem Chand and Bros.
- Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan PressLtd.1996.

Reference Books:

1. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.

2. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and 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 Wesly Publishing Company, 1996.

6. Hobbs.F.D."Traffic Planning and Engineering",University of Brimingham,Peragamon Press Ltd,2005.

E-Resources

- https://archive.nptel.ac.in/courses/105/105/105105215

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
C1	3		1			2	1	2					2		
C2	3	2	2	3	2	2			2				2	2	
C3	3	2	2	3	2	2		2	2		2	2		2	
C4	3	1		1	2	2	1	2	2	2	2	2			
C	3	1.25	1.25	1.75	1.5	2	0.5	1.5	1.5	0.5	1	1	1	1	

OCCUPATIONAL HEALTH AND SAFETY						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
21CVP733	**3-0-0-0**	**3**	**50**	**50**	**3 hours**	**40**

Prerequisites:

Basic knowledge on Ergonomics.

Course Objectives:

- Learn methods to identify and evaluate exposure to health hazards.
- Knowledge on work practices and controls to protect worker's health.
- Understand OSHA exposure limits and workplace standards to health hazards.

Syllabus

Module – 1 **[8 hours]**

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. **(6L+2T)**

Module – 2 **[8 hours]**

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.

(6L+2T)

Module – 3 **[8 hours]**

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. **(6L+2T)**

Module – 4 **[8 hours]**

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. **(6L+2T)**

Module – 5 **[8 hours]**

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. **(6L+2T)**

Course Outcomes:

- Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
- Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
- 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.
- Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
- Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Text Books:

- Goetsch D. L.,(1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
- HeinrichH.W.,(2007),"IndustrialAccidentPrevention-AScientificApproach",McGraw-HillBookCompany National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
- "Industrial Safety and Pollution Control Handbook.

Reference Books:

- 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.

E-Resources

https://www.youtube.com/watch?v=n7oUOUCIblg

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	PS01	PS02	PS03
CO1						3	3	2				2			
CO2						3	3	2				2			
CO3						3	3	3				2			
CO4						3	3	3				2			
CO5						3	3	3				3			
CO						3	3	2.2				2.1			

SOLID WASTE MANAGEMENT

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVP741	2-2-0-0	3	50	50	3 hours	40

Prerequisites:

Basic knowledge on different types of waste.

Course 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 disposal methods.

Syllabus

Module – 1 **[8 hours]**

Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste - Factors Influencing generation of solid waste - sampling and characterization, 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. **(6L+2T)**

Module – 2 **[8 hours]**

Basic Elements In Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste.

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). **(6L+2T)**

Module – 3 **[8 hours]**

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. **(6L+2T)**

Module – 4 **[8 hours]**

Biomedical waste E-waste: Sources, collection, treatment and disposal-Landfills: Site selection, design and operation.

Construction and Demolition waste: Sources, collection, treatment and disposal. **(6L+2T)**

Module – 5 **[8 hours]**

Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolsis, biogas generation and Energy recover technique from solid waste management. Hazardous waste. **(6L+2T)**

Course Outcomes:

Students will be able to

1. Analyze existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system and its processing techniques.
3. Suggest suitable scientific methods for solid waste management elements.
4. Apply technologies to process waste and dispose of Biomedical and demolition waste.
5. Design suitable processing system and evaluate disposal sites.

Text Books:

1. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd
2. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition.
3. Vesilind, P.A., Worrell, W., Reinhart, D. "Solid Waste Engineering", Cenage learning, New Delhi, 2004

Reference Books:

1. White, F. R., Franke P. R.,, & Hindle M., Integrated solid waste management: a life cycle inventory. McDougall,P. John Wiley & Sons. 2001.
2. 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
3. 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.
4. 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 007135623

E-Resources

1. https://nptel.ac.in/courses/105103205
2. https://www.youtube.com/watch?v=k0ktJRoRcOA
3. https://nptel.ac.in/courses/103/107/103107125/
4. https://onlinecourses.nptel.ac.in/noc22_ce76/preview
5. https://onlinecourses.swayam2.ac.in/cec20_ge13/preview

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3	2	1				1			
CO2						2	3	1				2			
CO3						3	3	2				2			
CO4						3	3	3				3			
CO5						3	3	3				3			
C						**2.8**	**2.8**	**2**				**2.2**			

CONSTRUCTION PLANNING AND TECHNIQUES

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21CVP742	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Basic knowledge of construction planning

Course Objectives:

The students will be able to:

- Inculcate the principles of construction project management
- Learn the elements of construction planning and scheduling
- Study different scheduling methods
- Understand the evaluation of the project strategies and optimizing the characteristics of project.
- Get insight information on resource management system

Syllabus

Module – 1

Introduction: Basic Concepts - Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities -Estimating Activity Duration. Estimating Resource Requirements for Work Activities - Coding Systems, Work Breakdown Structure (WBS), Defining Project Activities

[8 hours]

Module – 2

Construction Planning and scheduling Techniques: Planning and Scheduling , needs of Planning and Scheduling, Steps in Planning and Scheduling, Advantages of Planning and Scheduling, Time Management Function Details– Planning, Scheduling and Project Control.

[8 hours]

Module – 3

CPM and PERT: Introduction to Critical Path Method (CPM), its applications, Network fundamentals, Numerical on Fulkerson's rule. Program Evaluation Review technique (PERT) and its uses and importance, Numerical on Time estimates.

Precedence Diagram Method (PDM) - four types of relationships and three types for lag, network design (PDM calculation) and analysis.

[8 hours]

Module – 4

LOB: Introduction to Line of Balance (LOB) Scheduling, construction and prepare of LOB, Line of balance (LOB) technique Need and methods, Numerical on LOB, linear programming chart (LPC); Links, lead/lags, types of schedule constraints and effect.

Cost & Network: Time-Cost Trade-off, Direct cost, Indirect cost, Total project cost, Cost optimization, Cost Control in Construction, Numerical on crashing of network.

[8 hours]

Module – 5

Resource Allocation: Introduction, Resource usage profiles, Project updating, Planning, levelling and Allocation, Numerical on Resource allocation, Monitoring and control, progress monitoring, records, reports, assessment and review; Updation and revision of project plan.

Earned value Analysis: Introduction to earned value analysis, and Components - Budgeted Cost of Work Scheduled (BCWS) Budgeted Cost of Work Performed (BCWP) Actual Cost of Work Performed (ACWP), Schedule Variance (SV): Schedule Performance Index, Cost Variance (CV): Cost Performance Index, Estimate to Complete (ETC) budget at completion (BAC), Estimate at Completion (EAC).

[8 hours]

Course Outcomes:

Students will be able to

- Gain insight on principles of construction project management
- Apply knowledge on preparing project plans, schedule of construction, and project organization.
- Formulate and solve problems on construction network and time estimates.
- Identify and apply time cost tradeoff principles and cost control in construction.
- Design information system on resources and perform earned value analysis

Text Books:

- Chitkara K K, Construction Project Management, 10th Reprint, Tata McGraw Hill, 2006., ISBN-13: 978-9339205447.
- Callaghan, M.T., Quackenbush, D.G. and Rowings, J.E. (1992) "Construction Project Scheduling", McGraw-Hill.
- Harris, R.B. (1978) "Precedence and Arrow Network Techniques for Construction", John Wiley and Sons.

Reference Books:

- Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
- Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
- S.C Sharma –"Construction Equipment and its management" – Khanna publishers
- Srinath L.S, "PERT and CPM", 3rd Edition, East West Press Pvt. Ltd. New Delhi. 2001, ISBN-13: 978-8185336206
- Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
- Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, New Delhi
- Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell.

E-Resources

- https://nptel.ac.in/courses/110/107/110107081/

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					1					3	1	2	2	
CO2	3					1					3	1	2	2	
CO3	3	3				1					3	1	2	2	
CO4	3	3				1					3	1	2	2	
CO5	3					1					3	1	2	2	
C	3	3				1					3	1	2	2	

NATURAL DISASTER MITIGATION AND MANAGEMENT						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
21CVP743	**3-0-0-0**	**3**	**50**	**50**	**3 hours**	**40**

Course Objectives:

- Understand about types of Natural Disasters and Disaster Management Cycle.
- Develop skills in various stages of preparedness, mitigation and Management of Natural Hazards.
- Obtain Complete Knowledge on the Water and Weather related Disaster Management.
- Apply knowledge of Space Technologies and Early warning systems in Disaster Management.
- Demonstrate the knowledge of Various Organization and Stakeholders Working on Disaster Management.

Syllabus

Module – 1 **[8 hours]**

Natural Disasters – Overview:

Introduction- Natural Disasters around the world-Natural Disaster Risk Assessment– Human Dimensions of Global environment Change - Disaster mitigation, preparedness, response and recovery- comprehensive emergency management. Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food, Nutrition and Shelter -Role of UN Red cross and NGOs.

Module – 2 **[8 hours]**

Natural Hazards: Introduction and Review - Natural Disasters - Principles, Elements, and Systems- Geological – Geo morphological aspects, Earthquake- Geology, Seismology, Characteristics and dimensions – Landslides - Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc.- Tsunami - Nature and characteristics.

Module – 3 **[8 hours]**

Critical climate system aspects and Processes:- Hydrological cycle - Severe Weather and Tornadoes, Cyclones, Floods and Droughts - Global Patterns - Mitigation and Preparation – Drought – Famine- nature and dimensions– Drought Assessment & Monitoring.

Module – 4 **[8 hours]**

Natural Disaster Assessment and Communication: Applications of Science and Technology for Disaster Management, Geo-informatics in Disaster Management (GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination – Mobile Communications.

Module – 5 **[8 hours]**

Administrative mechanisms: Structure of rescue system, Community and Social organizations –Education and Training – Establishment of capacity building among various stakeholders – Government - Educational institutions – Use of Multi-media knowledge products for self-education.

Course Outcomes:

- To understand basic Concept and Phases of Disaster Management.
- To know the effects of natural hazards and their vulnerability.
- Understand applications of disaster management using recent trends.

- Develop organizational and Administrative strategies for managing Natural Hazards.

Text Books:

- Kovach, Robert L.: "Earth's Fury: An Introduction to Natural Hazards and Disasters", Englewood Cliffs, N.J., Prentice Hall, 1995.
- B.Narayan: "Disaster Management", S.B.Nangia, A P H publishing corporation, Delhi-2014
- Siddhartha Gautam, K Leelakrishna Rao: "Natural disaster Management", 3rd Edition, 2012, ISBN: 9381604320.

Reference Books:

- Arul Jothi, D L Balaji: "Safety and Disaster Management Education In Schools", 1st Edition, Anmol Publications, 2009, ISBN: 9380252609.
- R B Singh "Natural Hazards and Disaster Management: Vulnerability and Mitigation" Rawat Publication 2006, ISBN : 8131600335, 9788131600337.

E-Resources

- https://www.ndma.gov.in/en/
- https://www.ksndmc.org/Default.as
- www.nrdms.gov.in/natural_disaster.asp

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					1					3	1	2	2	
CO2	3					1					3	1	2	2	
CO3	3	3				1					3	1	2	2	
CO4	3	3				1					3	1	2	2	
CO5	3					1					3	1	2	2	
C	3	3				1					3	1	2	2	

REMOTE SENSING AND GIS

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21XXX751	3-0-0-0	3	50	50	3 hours	40

Course Objectives:

- The students will be learning:
- •About the principles of remote sensing and spectral signatures.
- About satellites, types of remote sensing, enhancement and information extraction
- and digital image processing
- About GIS mapping and analysis Techniques.
- Application of RS and GIS is various domains including Watershed management,
- Irrigation management, Drought and Flood monitoring, Environment and ecology.

Syllabus

Module – I

Principles of Remote Sensing: Introduction to remote sensing & system. Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Active & Passive Microwave Remote Sensing: Basics–physics of RADAR waves, spectral characteristics of RADAR waves, microwave radiometers, passive microwave scanners and sensors.

08 Hrs

Module – II

Platforms, Sensors and Data Products: Introduction - Ground aircraft, space aircraft platforms-photographic sensors, scanners, radiometers, and Mission planning. Data types and format, Scale and Legend., platforms- Indian satellite IRS and Landsat specifications, Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal) Basic elements in Image interpretation.

08 Hrs

Module – III

Geographic Information System: Introduction, history of GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation processes and capabilities, different types of GIS, GIS data- spatial and non-spatial, data models with advantages and disadvantages. Drone survey and its application

08 Hrs

Module – IV

Hyper-spectral Remote Sensing: spectral concepts, Imaging and data collection systems- calibration techniques, data processing techniques; preprocessing, N dimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and spaceborne hyper- spectral sensors, applications. High-resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications. GNSS, IRNSS, GPS and its application.

08 Hrs

Module – V

Applications of RS and GIS in Civil Engineering: Water resource management, Ground water studies, Agriculture, Earthquake hazardous studies, Urban Development Planning, Flood monitoring, Drought monitoring, Transportation engineering, Watershed management, Irrigation management, Site selection for Dams, Bridges and Reservoirs.

08 Hrs

Course Outcomes:

Students will be able to

- Demonstrate the concepts of Electromagnetic energy, spectrum and spectral signature curves.
- Apply the concepts of satellite and sensor parameters and characteristics of different platforms.
- Prepare spatial Maps in GIS and be able to Interpret GIS Maps.
- Design the Hyper spectral remote sensing systems.
- Solve complex Civil engineering Problems using RS and GIS techniques.

Text Books:

- Lilles and T.M and R.W. Kiefer: "Remote sensing and image interpretation", (Chapters 1-8), 4th Edition, John Wiley and Sons, 2000, ISBN: 9780470052457.
- Jensen J.R: "Introductory digital image processing, a remote sensing perspective", (Chapters 1-4), 2nd Edition Prentice Hall, 1996, ISBN: 9780132058407.
- Richards J.A., and X. Jia: "Remote sensing digital image analysis: an introduction", (Chapters 1-3), 3rd Edition, Springer, 2006, ISBN: 9783540297116.
- Mikhail E., J. Bethel, and J.C. McGlone: "Introduction to modern photogramme- try", (Chapters 5-9), Wiley, 2001, ISBN: 9780471309246.

Reference Books:

- Ravi P Gupta: "Remote sensing Geology", (Chapters 1-8), Springer Verilag, New York, ISBN: 9783662052839
- Mather P.M.: "Computer processing of remotely-sensed images, an introduction",
- ISBN: 9781119956419.

E-Resources:

- http://www.set.ait.ac.th/page.php?fol=rsgisandpage=rsgis
- http://geology.wlu.edu/harbor/geol260/lecture_notes/notes.html
- http://www.rejinpaul.com/2014/10/vtu-civil-notes-vtu-civil-enigneering-1st- 2nd-3rd-4th-5th-6th-7th-8th-semester-lecture-notes-download-load.html
- http://www.rejinpaul.com/2013/12/civil-2nd-4th-6th-8th-semester-notes-an- na-universitycivil-notes.html

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1												1		3
CO2					1					3					3
CO3				1	3		3							3	
CO4						3							3	3	
CO5			1		1								1	1	3
CO	1		1	1	1.2	3	3			3			1.2	2.2	3

MUNICIPAL WASTE WATER TREATMENT						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
21XXX752	**3-0-0-0**	**3**	**50**	**50**	**3 hours**	**40**

Course Objectives:

- Understand the various types of sewerage systems, sewage disposal methods and sewer appurtenances.
- Understand the design of sewers and the waste water characteristics.
- Understand the concept and design of various waste water treatment units.
- Understand the concept and design of various biological treatment units.
- Understand the concept of various advance waste water and low cost treatment processes for rural areas.

Syllabus

Module – 1

Sewerage Systems: Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors affecting dry and wet weather flow on design of sewerage system, estimation of storm water flow, time of concentration flow.

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.

[8 hours]

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.

Wastewater 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).

[8 hours]

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.

[8 hours]

Module – 4

Biological Treatment Process: Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, and rotating biological contactors.

Sludge Disposal: Principle of stabilization ponds, oxidation ditch, Sludge digesters (aerobic and anaerobic), Equalization, thickeners and drying beds.

[8 hours]

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, and soak pits

[8 hours]

Course Outcomes:

- Knowledge on sewer appurtenances and materials for sewer network.
- Design the sewer network based on physcio chemical properties of waste water
- Design of treatment units of municipal waste water.
- Design of various biological treatment units and sludge disposal methods.
- Understand the various AOPs and low cost treatment units for rural sanitation.

Text Books:

- Nelson L Nemerow: "Liquid Waste of industry, Theories, Practices and Treatment", Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
- Rao M N, Dutta A.K: "Waste water treatment", 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.
- Rao M N, Dutta A.K: "Waste water treatment", 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.
- Metcalf and Eddy Inc, "Wastewater Engineering - Treatment and Reuse", Publishing Co. Ltd., New Delhi, 4th Edition, 2009.

Reference Books:

- CPHEEO manual on sewage treatment, Ministry of Urban Development, Government of India, New Delhi,1999
- Mark.J Hammer, "Water & Waste Water Technology" John Wiley & Sons Inc., New York, 2008
- Benefield R.D., and Randal C.W, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey 2012

E-Resources

- www.neerienvis.nic.in/pdf/
- www.fao.org/
- www.gewater.com/applications, www.waterleau.com/en

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1												1		3
CO2					1					3					3
CO3				1	3		3							3	
CO4						3							3	3	
CO5			1		1								1	1	3
CO	1		1	1	1.2	3	3			3			1.2	2.2	3

ENVIRONMENTAL IMPACT ASSESSMENT

Course Code	L-T-P-S (Hrs/week)	Credits	CIE Marks	SEE Marks	SEE Duration	Total Lecture Hours
21XXX753	3-0-0-0	3	50	50	3 hours	40

Prerequisites:

Basic knowledge on Ergonomics.

Course Objectives:

- Define and Classify Environmental Impacts and the terminology.
- Understands the environmental Impact assessment procedure.
- Explain the EIA methodology.
- List and describe environmental audits.

Syllabus

Module – 1

Introduction to Environmental Impact Assessment

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

[8 hours]

Module – 2

EIA Methodologies:

Environmental attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts**.**

[8 hours]

Module – 3

Environmental Management Plan:

EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

[8 hours]

Module – 4

Environmental Legislation and Life cycle Assessment:

Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules.

Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria- case studies.

[8 hours]

Module – 5

Case Studies:

Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

[8 hours]

Course Outcomes:

- Identify the environmental attributes to be considered for the EIA study.
- Formulate objectives of the EIA studies.
- Identify the methodology to prepare rapid EIA.
- Preparation of EIA reports and interpretation of results.

Text Books:

- Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
- Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

Reference Books:

- Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
- Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.

E-Resources

https://onlinecourses.nptel.ac.in/noc22_ar07/preview

	PO's												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PS01**	**PS02**	**PS03**
CO1						3	3	2				2			
CO2						3	3	2				2			
CO3						3	3	3				2			
CO4						3	3	3				2			
CO						**3**	**3**	**2.2**				**2**			