Malnad College of Engineering, Hassan

[An Autonomous Institution Affiliated to VTU Belagavi]

Autonomous Programme

Bachelor of Engineering in Civil Engineering
Scheme & Syllabus

V & VI Semester

(2024-25 Admitted Batch)

Academic Year:2026-27

Department of Civil Engineering

Vision of the Department

To establish excellence in Civil Engineering education through sustainable design and execution ethical innovation and applied research.

Mission of the Department

1. To Impart education to design durable, resource-efficient structures using optimization design and lifecycle analysis to minimize environmental impact while maximizing service life.

2. To translate academic research into field-validated solutions through consultancy, training, structured testing programs and Institute industry partnerships.

3. To maintain uncompromising commitment to professional codes, public safety, and ethical practices in all design, innovation, and construction activities.

Program Educational Objectives (PEOs)

PEO 1: Graduates will thrive in civil engineering careers, leading construction, infrastructure, innovative technologies, and sustainable green building projects while advancing research and pursuing higher education.

PEO 2: Graduates will demonstrate strong professional expertise in the broad spectrum of civil engineering knowledge and interdisciplinary areas.

PEO 3: Graduates will be a team leader/effective team member with uncompromising commitment to professional codes, public safety, ethics and responsible innovation, achieving compliance with standards in practice.

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **Design/Development of solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
4. **Conduct investigations of complex problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. **Engineering tool usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6. **The engineer and the world**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **Individual and collaborative team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary settings.
9. **Communication:** Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
10. **Project management and finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. **Life-long learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES

PSO1: Design and execute civil engineering systems, components or processes to meet project needs through sustainable design principles and lifecycle optimization.

PSO2 : Apply professional civil engineering software tools to solve design challenges compliant with relevant codes and industry relevant outcomes.

MALNAD COLLEGE OF ENGINEERING

(Autonomous)

(Approved by AICTE, New Delhi and Affiliated to Visvesvaraya Technological University, Belagavi)

Accredited by NAAC and NBA

HASSAN- 573 202, Karnataka, India

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Bachelor of Engineering in Civil Engineering

Scheme & Syllabus V & VI Semester

(2024-25 Admitted Batch)

Academic Year:2026-27

Department of Civil Engineering

THIRD SEMESTER												
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	PCC	24CV301	Engineering Geology ,Building Materials and Components	3	0	0	3	50	50	100	3
2	IPCC	24CV302	Engineering Surveying	3	0	2	5	50	50	100	4
3	IPCC	24CV303	Strength of Materials	3	0	2	5	50	50	100	4
4	PCC	24CV304	Water Supply and Treatment Engineering	3	0	0	3	50	50	100	3
5	PCCL	24CV305	Computer Aided Building Planning and Drawing	0	0	2	2	50	50	100	1
6	ESC		ESC/ETC/PLC	2	0	2	4	50	50	100	3
7	UHV	24SCR	Social Connect and Responsibility	0	0	2	2	100	-	100	1
8	AEC/ SEC		Ability Enhancement Course/Skill EnhancementCourse-III	If the course is a Theory				50	50	100	1
				1	0	0	1				
				If the course is a laboratory							
				0	0	2	2				
9	MC	24NYP1	NSS,YOGA,PE	0	0	2	2	100	-	100	A
10	BSC	24BCM301	Bridge Mathematics-I (Mandate Audit Course for Diploma entry students)	3	0	0	3	100	-	100	A
			Total	18		14	32				20
Note: AEC, SEC, ETC courses are to be chosen suitably by the BOS of the programme											

Engineering Science Course(ESC/ETC/PLC)	
Course Code	**Course Name**
24CV306A	Urban and Rural Planning
24CV306B	Sustainability in Engineering Design
24CV306C	Environmental protection and Management
Ability Enhancement Course–III	
24CV358A	Smart Urban Infrastructure
24CVL358B	Digital Drafting for Civil Engineers (Lab)
24CVL358C	Skill Lab

FOURTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	PCC	24CV401	Basic Structural Analysis	3	0	0	3	50	50	100	3
2	IPCC	24CV402	Fluid Mechanics and Hydraulics	3	0	2	5	50	50	100	4
3	IPCC	24CV403	Concrete Technology	3	0	2	5	50	50	100	4
4	ESC		ESC/ETC/PLC	3	0	0	3	50	50	100	3
5	UHV	24UHV	Universal Human Values	0	2	0	2	50	50	100	1
6	AEC/SEC		Ability Enhancement Course/Skill Enhancement Course- IV	If the course is a Theory				50	50	100	1
				1	0	0	1				
				If the course is a laboratory							
				0	0	2	2				
7	MC	24NYP2	NSS,YOGA,PE	0	0	2	2	100	-	100	A
8	BSC	24BE406	Biology for Engineers	0	2	0	2	50	50	100	1
			Total	13	04	08	25				17
Note: AEC, SEC, ETC courses are to be chosen suitably by the BOS of the programme											

Engineering Science Course (ESC/ETC/PLC)	
Course Code	**Course Name**
24CV404A	Building Information Modelling in Architecture, Engineering and Construction (BIM)
24CV404B	Construction Equipment, Plants and Machinery
24CV404C	Concrete Design and Placements
24CV404D	Hydrology and Water Resources Engineering
24CV404E	Waste water engineering
Ability Enhancement Course–III	
Course Code	**Course Name**
24CVL405A	Total Station Application in Civil Engineering (Lab)
24CV405B	Components of a Smart City

FIFTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	PCC	24CV501	Advanced Structural Analysis	3	0	0	3	50	50	100	3
2	PCC	24CV502	Construction Planning and Management	3	0	0	3	50	50	100	3
3	IPCC	24CV503	Geotechnical Engineering	3	0	2	5	50	50	100	4
4	IPCC	24CV504	Transportation Engineering	3	0	2	5	50	50	100	4
5	PCCL	24CV505	Environmental Engineering Laboratory	0	0	2	2	50	50	100	1
6	HSMC	24EVS	Environmental Studies	1	0	0	2	50	50	100	1
7	PEC	24CV56X	Professional Elective Course – I	3	0	0	3	50	50	100	3
8	MC	24NYP3	NSS,YOGA,PE	0	0	2	2	100	-	100	A
9	AEC	24RIP	Research Methodology and IPR	3	0	0	3	50	50	100	3
			Total	19	0	08	27				22

Professional Elective Courses	
Course Code	**Course Name**
24CV561	Occupational Safety and Health assessment
24CV562	Remote Sensing and GIS
24CV563	Groundwater Development and Management
24CV564	Repair and Rehabilitation of Structures
24CV565	Stability Analysis of Slopes
24CV566	Environmental Impact Assessment
24CV567	Traffic Engineering, Road Safety and Management
24CV568	Theory of Elasticity

SIXTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	IPCC	24CV601	Design and Detailing of RC Structures	3	0	2	5	50	50	100	4
2	PCC	24CV602	Irrigation Engineering and Hydraulic Structures	3	0	0	3	50	50	100	3
3	PCC	24CV603	Applied Geotechnical Engineering	3	0	0	3	50	50	100	3
4	PI	24PROJ1	Main Project Phase-I	0	0	4	4	50	50	100	2
5	PEC	24CV65X	Professional Elective Course - II	3	0	0	3	50	50	100	3
6	OEC	24OEXX	Open Elective Course-I	3	0	0	3	50	50	100	3
7	PCCL	24CVL606	Software Application Lab	0	0	2	2	50	50	100	1
8	PCC	24CV607	Advanced Survey Training	0	0	2	2	50	50	100	1
9	OEC	24SWY	*Swayam (NPTEL only)	AUDIT							
10	MC	24NYP4	NSS,YOGA,PE	0	0	2	2	100	-	100	A
11	AEC	24ASK	Analytical Ability and Soft Skills	0	0	2	2	50	50	100	1
			Total	15	0	12	27				21

Professional Elective Course-II	
Course Code	**Course Name**
24CV651	Structural dynamics
24CV652	Pavement Analysis and Design
24CV653	Rural Water Supply & Sanitation
24CV654	Groundwater Hydraulics
24CV655	Modern Construction Methods and Mechanization
24CV656	Composites & Smart Materials
24CV657	Solid Waste Management

Open Elective Course-I	
Course Code	**Course Name**
24OECV661	Water Supply and Sanitation
24OECV662	Composite and Smart Materials
24OECV663	Hazardous Waste Management
24OECV664	Sustainability in Engineering System
24OECV665	Railway Engineering
24OECV666	Remote Sensing and GIS
24OECV667	Water Resources Management
24OECV668	Engineering Optimization
24OECV669	Engineering Hydrology

SEVENTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	PCC	24CV701	Specifications & Quantity Surveying	3	0	0	3	50	50	100	3
2	PCC	24CV702	Prestressed Concrete Structures	3	0	0	3	50	50	100	3
3	IPCC	24CV703	Design of Steel Structures	3	0	2	5	50	50	100	4
4	PCC	24CV704	Design of Bridges and Flyovers	3	0	0	3	50	50	100	3
5	PCC	24CV705	Technical Seminar	0	0	2	2	50	50	100	1
6	PI	24PROJ2	Main Project Phase-II	0	0	8	8	50	50	100	4
7	PEC	24CV76X	Professional Elective Course - III	3	0	0	3	50	50	100	3
8	OEC	24OECV 77X	Open Elective Course–II	3	0	0	3	50	50	100	3
Total				18	02	10	30				24

Professional Elective Course-III	
Course Code	**Course Name**
24CV761	Railway, Harbour & Airport Engineering
24CV762	Earthquake Resistant Design of Structures
24CV763	Advanced Foundation Design
24CV764	Industrial Wastewater Treatment
24CV765	Advanced Design of RC Structures
24CV766	Finite Element Analysis
24CV767	Urban Design and Regeneration
24CV768	Watershed Management

Open Elective Course-II	
Course Code	**Course Name**
24OECV771	Water Supply and Sanitation
24OECV772	Composite and Smart Materials
24OECV773	Hazardous Waste Management
24OECV774	Sustainability in Engineering System
24OECV775	Railway Engineering
24OECV776	Remote Sensing and GIS
24OECV777	Water Resources Management
24OECV778	Engineering Optimization
24OECV779	Engineering Hydrology

EIGHTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	PEC	24SW01	Professional Elective (Online Course)	3	0	0	3	50	50	100	3
2	OEC	24SW02	Open Elective (Online course)	3	0	0	3	50	50	100	3
3	PI	24INT	Internship (Research/Industry) (15-20 weeks)	0	0	12	12	100	100	200	10
Total				6	0	12	18				**16**

Semester Credit Structure 2024-25 Batch

Year	Semester	Credits
Second	Third	20
	Fourth	17
Third	Fifth	22
	Sixth	21
Fourth	Seventh	24
	Eighth	16
	Total Credits	**120**

Credits Earned in First Year= 40
Total Credits (considering all years)= 160

Malnad College of Engineering, Hassan

Department of Civil Engineering

Scheme of Evaluation for Theory Courses

	Portions for CIE	Mode of Evaluation	Weight age in Marks
CIE-1	Syllabus to be decided by the Course Coordinators such that the entire COs shall be covered.	Descriptive Test	10
CIE-2		Descriptive Test	10
CIE-3		Descriptive Test	10
Activity	Minimum of Two Activities to be conducted	Assignment/Case Study/Practical/ Working Model/Quiz	20
		Total	50

Examination		Max. Marks	Minimum Marks to be scored	Minimum Average Marks to qualify
CIE	Tests	30	12 (>=40%)	40 (= 40%)
	Activities	20	08 (>=40%)	
SEE		50	17.50 (>=35%)	

Scheme of Evaluation for Laboratory Courses

Evaluation Type	Evaluation Modules	Marks
Continuous Internal Evaluation (C.I.E.) in every Laboratory session by the Course Coordinator	**Conduction of Experiments**	**10**
	Observation and Tabulation of Results	**10**
	Record Writing	**20**
	Viva-Voce/Quiz	**10**
Continuous Internal Evaluation(C.I.E.)		**50**
Semester End Examination (S.E.E.)		**50**

Note: The marks distribution to be made based on the rubrics for a particular laboratory course.

COURSE TYPES

Basic Science Course	BSC
Engineering Science Course	ESC
Emerging Technology Course	ETC
Programming Language Course	PLC
Professional Core Course	PCC
Integrated Professional Core Course	IPCC
Professional Core Course Laboratory	PCCL
Professional Elective Course	PEC
Open Elective Course	OEC
Project/Mini Project/Internship	PI
Humanities and Social Sciences, Management Course	HSMC
Ability Enhancement Course	AEC
Skill Enhancement Course	SEC
Universal Human Value Course	UHV
Non-credit Mandatory Course	MC

Course Title	ADVANCED STRUCTURAL ANALYSIS		
Course Code	24CV501	**(L-T-P)C**	(3-0-0) 3
Exam	3 Hrs.	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+ 48ABL= 90

Course Objective: To impart knowledge about various methods involved in the analysis of indeterminate structures.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Analyze the structures subjected to moving loads	PO1, PO2, PO3	PSO1
2	Carryout analysis of indeterminate structures by slope deflection	PO2, PO3, PO4	PSO1
3	Analyze indeterminate structures by moment distribution method	PO2, PO3, PO4	PSO1
4	Analyze indeterminate structures by moment distribution method	PO2, PO3, PO4	PSO1

MODULE-1 — 10 Hrs.

Influence lines and moving loads: Definition & importance of influence line diagram, Influence line diagram for reactions, shear force & bending moment for simply supported beams, Determination of maximum shear force & bending moment at a section and absolute maximum shear force & bending moment in simply supported beams due to moving UDL & series of point loads. **Analysis of continuous beams by Slope Deflection Method:** Development of Slope- Deflection equations - Analysis of Continuous Beams with kinematic indeterminacy not more than three.

Self-study component: Students shall visit different types of structures subjected to moving loads and should observe behaviour of structures.

MODULE-2 — 10 Hrs.

Analysis of frames by Slope Deflection Method: Analysis of orthogonal rigid jointed Plane frames with kinematic indeterminacy not more than three. (both sway & non-sway type). **Analysis of continuous beams by Moment Distribution Method:** Definition of terms distribution factor, carry over factor, Analysis of Continuous Beams with kinematic indeterminacy not more than three.

Self-study component: Students shall work on a standard software for structural analysis and compare the results for simple structural units like continuous beams and portal frames
MODULE-3 **10 Hrs.**
Analysis of frames by Moment Distribution Method: Analysis of orthogonal rigid jointed Plane frames with kinematic indeterminacy not more than three (both sway & non-sway type). **Analysis of continuous beams by Kani's Rotation Contribution Method:** Definition of terms rotation factor, rotation contribution, Analysis of Continuous Beams with kinematic indeterminacy not more than three. ***Self-study component: Students shall work on a standard software for structural analysis and compare the results for simple structural units like continuous beams and portal frames***
MODULE-4 **10 Hrs.**
Analysis of frames by Kani's Rotation Contribution Method: Analysis of orthogonal rigid jointed Plane frames with kinematic indeterminacy not more than three. (only non-sway type). **Introduction to Plastic analysis of structures:** Ductility of materials, Plastic deformation, Plastic hinge, Plastic analysis of continuous beams and simple quadrangular frames. ***Self-study component: Students shall refer to the case study of plastic hinge development of structures.***

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	"Analysis of Structures"	Vazirani V. N. & Ratwani M. N.	15th	Khanna publications, New Delhi	2002
2	Basic Structural Analysis	Reddy C. S	2nd	Tata Mc Graw Hill Publishing Co.ltd	2006

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Theory of Structures	Ramamrutham. S	9th	Dhanpath Rai Publications, New Delhi	2014
2	Statically indeterminate structures	Wang C.K	1st	Tata McGraw Hill Publishing Co. Ltd, Tokyo	1953

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/105/101/105101086/
2. https://archive.nptel.ac.in/courses/105/106/105106050/
3. https://archive.nptel.ac.in/courses/105/105/105105109/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Collaborative Activity 2) Assignment	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Group Problem Solving:Solving indeterminate structures using different methods	**10**
2	Assignment	04
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Conceptual and analytical quizzes	**01**
2	Design and analysis of structural systems under constraints	12
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test(1,2 and 3)	3
Quiz(1and 2)(optional)	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2	2									1	
CO2		3	2	2								1	
CO3		3	2	2								1	
CO4		3	2	2								1	

Course Title	CONSTRUCTION PLANNING AND MANAGEMENT		
Course Code	24CV502	**(L-T-P)C**	(3-0-0)3
Exam	03 Hrs.	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+ 48ABL=90

Course Objective: To develop the ability to evaluate construction methods, materials, and equipment, and to effectively apply construction management principles while collaborating within a multidisciplinary team environment.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Analyze alternative project proposals using engineering economic principles to assess project feasibility through financial indicators such as Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit-Cost Ratio.	PO1, PO2, PO10	
2	Apply linear programming techniques, including graphical and simplex methods, as tools for optimizing resource allocation and decision-making in engineering projects.	PO1, PO10	
3	Apply construction management principles and planning techniques such as CPM and PERT to optimize project cost and schedule efficiency.	PO1, PO10	
4	Develop a structured understanding of construction processes, project management stages, and transportation strategies to achieve optimal project outcomes.	PO1, PO6, PO10,	

MODULE-1	**10 Hrs.**

Introduction to Engineering Economics – Basic concepts of engineering Economic analysis – Micro and Macro analysis – project feasibility –economic and financial feasibility. Engineering Planning Methods: Time value of money - interest formula – present worth – future worth - annual equivalent – rate of return and benefit cost ratio methods for comparison of alternative project proposals – breakeven analysis.

Self-study component: Students shall visit a construction site and discuss the points pertaining to project planning, financing and time schedule, prepare a report and submit.

MODULE-2	**10 Hrs.**

Linear Programming: Standard form of a linear programming– problem Formulation – graphical solution – simplex method – maximization and Minimization-application problems.Construction **Industry and Management:** Introduction – value engineering Time management – labor and material management – contract and contractor-organization and administration.

Self-study component: Students shall visit a construction site and discuss the points pertaining to project management in terms of time, labor and material management, prepare a report and submit.

MODULE-3	**10 Hrs.**

Construction Planning: Introduction – time estimates – Bar and Milestone Charts – CPM and PERT network analysis – cost analysis – direct cost indirect cost – total cost – optimum cost – optimum duration of project.

Construction Equipment: Introduction – factors for selecting equipment – economic life of equipment - various earth moving equipment – hoisting equipment – trenching machines.

Self-study component: Students shall visit a construction site and observe bar charts exhibited at the site, various construction equipment, prepare a report and submit.

MODULE-4	**10 Hrs.**

Work Study in Construction, Project control during construction – Project supervision -safety measures. Transportation Problems: Introduction – Mathematical formulation Optimal solution of transportation problems – methods for initial basic feasible solution – summary of methods of initial BFS – North west corner method – Lowest cost entry method – Vogel's approximation method –optimality test – Degeneracy in Transportation Problems.

Self-study component: Students shall use any typical construction management software and prepare critical path for the execution of the project.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Construction Management	Subramaniam.K	4th	Anuradha Publishers, Madras, (Ch.1–5) 2)	2012
2	Construction Planning equipments and methods	Peurifoy, R L	6th	McGraw Hill Publications 3rd edition,	2021

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Construction Planning and Management"	Mahesh Varma	2nd	Metropolitan Book Co.Delhi	2019
2	Operation Research	Sharma.S.D	15th	Khanna Publishers, NewDelhi.	2010

EBooks and online course materials:

1. civlandstructureengineering.wordpress.com/wp-content/uploads/2015/08/construction-management-and-planning1.pdf
2. PII: B978-0-7506-6956-6.50000-9

Online Courses and Video Lectures:

1. Construction Management | Coursera
2. Microsoft PowerPoint - 5. Shri P G Venkat Ram- Bridge Construction methods and the failures associated with them

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Collaborative Activity 2) Assignment and quizzes	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Collaborative Activity- Students complete assignments using software (e.g., Microsoft Excel, MS Project) involving optimization problems, creating Gantt charts, or modeling systems.	15
Total		**15**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Conceptual quizzes- Regular short quizzes conducted for each module for understanding of the most recent concepts	02
2	Assignment are given in each module which will summarize the concept and formulas involved	10
Total		**12**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test (1,2 and 3)	3
Quiz (1and 2) (optional)	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2	3								3			
CO2	3									3			
CO3	3									3			
CO4	3					2				3			

Course Title	GEOTECHNICAL ENGINEERING		
Course Code	24CV503	**(L-T-P)C**	(3-0-2) 4
Exam	03 Hrs	**Hours/Week**	05
SEE	100 marks	**Total Hours**	42L+ 28P + 50ABL=120

Course Objective:

1. Understand the principles of soil mechanics and their application in engineering.

2. Develop practical skills in soil testing and analysis for accurate characterization of soil properties.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Evaluate and analyze the importance of basic properties of soil which will affect its strength and compressibility characteristics for design of foundation.	PO1, PO2, PO4	—
2	Apply the mechanism of flow of water through soil in the context of design and construction of embankments, canals etc.	PO1, PO2, PO3, PO4	—
3	Evaluate the importance of compaction characteristics of soil and the factors which affect the degree of compaction and the compressibility of soils.	PO1, PO2, PO3, PO4	—
4	Investigate and report on shear strength parameters of soil involving geo-physical exploration methods of subsurface investigation.	PO1, PO2, PO3, PO4	—-

MODULE-1	**10 Hrs.**

Introduction: Basic Definitions, Origin and formation of soil, Phase diagrams, Voids ratio, Porosity, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density - inter relationships, field identification of soils.

Index Properties of Soils: Definitions and importance of Index properties, particle size distribution, sedimentation analysis (Hydrometer analysis only) Importance of consistency limits, Classifications of Soils: Necessity, IS classification of soils, plasticity chart and its importance.

Self-Study Component (SSC): The Students shall visit work sites and try to identify different types of soils at the foundation level. They shall try to establish the type of soil by simple field

MODULE-2	**10 Hrs.**

Flow of Water Through Soil: Darcy's law - Assumptions and validity, seepage velocity, superficial velocity and their relationships, coefficient of percolation. Coefficient of permeability and its determination (excluding field method). Factors affecting permeability, Permeability of stratified soils. **Effective stress in Soils:** Total stress, effective stress and neutral stress, capillary phenomenon, Quicksand phenomenon.

Self-Study Component (SSC): The Students shall explore the permeability of soil samples collected from different locations within the campus.

MODULE-3	**10 Hrs.**

Compaction of Soils: Definition, objectives of the compaction, compaction tests, dry density and moisture content relationships, factors affecting compaction. Effect of compaction on soil properties. Field compaction methods -Rollers and vibrators; Field compaction control - Procter's needle, nuclear density gauge

Compressibility of Soils: Concept of compressibility, Mass-spring analogy - Terzaghi's one dimensional consolidation theory - Assumptions, limitations and applications (Derivation and mathematical solution not required) – Normal, under and over consolidated soils, Pre-consolidation pressure, e-logp curve, compressibility index, coefficient of consolidation and their importance.

Self-Study Component (SSC): The Students shall visit work sites like roads, embankments and watch compaction methods, collect test details and prepare a report on the same.

MODULE-4	**10 Hrs.**

Shear Strength of Soil: Concept of shear strength - Mohr' s strength theory, Mohr - Coulomb theory. Shear strength tests under different drainage conditions. Shear strength parameters, factors affecting shear strength of soils.

Subsurface Exploration: Necessity of sub-soil exploration, Borings method of soil exploration. Types of samplers- undisturbed, disturbed and representative samples, area ratio, recovery ratio. Field tests such as SPT, vane shear, SCPT, identification of soils. Geophysical methods: Electrical resistivity, Seismic refraction methods.

Self-Study Component (SSC): The Students shall visit a work site and observe the different types of exploration and prepare the report.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Principles of Soil Mechanics and Foundation Engineering	Murthy, V.N.S.	5th Revised Ed.,	UBS Publishers and Distributors ltd, NewDelhi,	2001
2	Soil Mechanics and Foundations	Punmia, B.C. Ashok Kumar Jain & Arun Kumar Jain	Revised	Laxmi Publishing Co., New Delhi.	2003

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Foundation Analysis and Designs	Bowles, J.E,	5th Ed.	Mc Graw Hill Publishing, New York	2008
2	Geotechnical Engineering	Venkataramaiah,C.	Revised third Ed.,	New Age International publishers,	2006

EBooks and online course materials:

1. **NPTEL: Civil Engineering - NOC:Geotechnical Engineering - 1**
2. **Teaching -Learning– Evaluation Scheme:**

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hour Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	2	14	28
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1&ABL2)	-	-	26
6	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**120**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Lab Component 2. Collaborative Activity	20
Total		**50**

Laboratory Plan :

Lab Program	Program Details
1	Determination of moisture content, specific gravity & grain size analysis of soil sample.
2	Determination of in situ density of soil by core cutter and sand replacement methods.
3	Determination of Liquid limit of soil sample by Casagrandes and cone penetration method.
4	Determination of Plastic limit & Shrinkage limit of Soil sample.
5	Determination of compaction characteristics of soil by standard & modified Proctor test.
6	Determination of Shear strength parameters of soil by Direct shear Test.
7	Determination of shear strength parameters of soil sample by Tri axial shear test and unconfined compression test.
8	Determination of Consolidation parameters of soil sample by Consolidometer test.

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1		**Hours**
1.	Lab Component - Enabling students to evaluate soil properties, analyze geotechnical behavior, and apply theoretical concepts to real-world engineering problems.	**14**
Total		
ABL2 (13 Hours): Activity 2		**Hours**
1.	Collaborative Activity - Students work in groups to classify soil samples based on their physical and engineering properties obtained from laboratory tests.	**13**
Total		

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test(1,2 and 3)	3
Quiz(1and 2)(optional)	1
Lab Test	3
Semester End Exam	3
Total	**10**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2		2									
CO2	3	2	2	1									
CO3	3	2	2	2									
CO4	3	2	2	1									

Course Title	TRANSPORTATION ENGINEERING		
Course Code	24CV504	(L-T-P)C	(3-0-2)4
Exam	3 Hrs	Hours/Week	05
SEE	100 marks	Total Hours	42L+28P+50ABL=120

Course Objective: To learn broader understandings on various aspects of transportation engineering

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Conduct necessary field investigation for generation of required data for proposing new alignment or re-alignment of existing roads	PO1, PO2, PO3	–
2	Evaluate the engineering properties of the materials and suggest the suitability of the same for the pavement construction.	PO1, PO2, PO3	–
3	Design the thickness of pavement (Flexible and Rigid) and various pavement evaluation methods.	PO1, PO2, PO3	PSO1
4	Evaluate the condition of highway drainage and associated problems and to evaluate the highway economics by various methods.	PO1, PO2, PO3	PSO1

MODULE-1 — 10 Hrs.

Introduction: Importance of transportation – Comparison with all the modes – characteristics of road transportation – Jayakar committee recommendations and Implementation – 3rd and 4th Road development plans, numerical problems. Present scenario of road development in India Highway **Planning and Alignment:** Different road patterns – Planning surveys –Factors affecting highway alignment, Ideal requirements – Steps in New and Realignment. Phasing of road construction.

Self-study component: Students will visit to understand the impact of different patterns of road to know the advantages and disadvantages of the pattern in regard to traffic flow conditions.

MODULE-2 — 10 Hrs.

Highway Geometric Design (No Derivation) – Importance – Controlling factors –Design speed Surface characteristics – cross sectional elements-– camber — sight distances – Horizontal and vertical alignment. Pavement Materials and Construction: CBR and plate load tests – properties and requirements of Road aggregates – Bitumen – Types, construction procedures for subbase, base and surface courses

Self-study component: Students will collect the data from State Highway department and design both horizontal and vertical geometrics and compare with existing geometrics	
MODULE-3	**10 Hrs.**
Pavement Design: Design factors – Determination of ESWL, problem (Graphical method) – IRC method design of flexible pavement (IRC38-2012)- Stresses in rigid pavement – IRC method of design rigid pavement (IRC58-2015) (Excluding design of joints and problems on the above). ***Self-study component: Students will visit ongoing project in and around Hassan city and to compare properties of materials analyzed with IRC specifications.***	
MODULE-4	**10 Hrs.**
Highway drainage: Surface drainage – types – functions, Sub surface drainage – Basic design principle. Highway Economics and financing: Highway user costs – VOC using charts – Highway costs – Economic analysis by Annual cost method – BCR method – Highway financing – BOT and BOOT concept ***Self-study component: Students will visit different roads and identify important types of failures and list the suggestions to overcome the failure.***	

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Highway Engineering	Khanna and Justo	10	Khanna publications New Delhi	2022
2	Highway Engineering	Kadiyali, L.R.	8	Khanna Publishers, New Delhi	2021

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Guidelines for the Design of Flexible Pavements	IRC	Code Book	IRC: 37-2012	2012
2	Guidelines for the Design of Rigid Pavements	IRC	Code book	IRC 58 - 2015	2015

EBooks and online course materials:

1. https://https://nptel.ac.in/courses/105107220

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Week s	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	2	14	28
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1&ABL2)	-	-	26
6	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**120**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Lab Component	20
Total		**50**

Laboratory Plan (if integrated course):

Lab Program	Program Details
1	Determination of soundness test on aggregates
2	Determination of Bitumen adhesion test on aggregate
3	Determination of flakiness index & elongation index for coarse aggregate
4	Concrete mix design by IS code method as per 10262-2019 & 456-2000
5	Demonstration of strength of cement concrete cube at specified age
6	Demonstration of the strength/flexural strength of a cement concrete beam at a specified age.
7	Determination of specific gravity & penetration of bitumen.
8	Determination of ductility & softening point of bitumen.
9	Determination of flash and fire point & viscosity of bitumen.
10	Demonstration of Marshall stability test on bituminous material.

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Case Study & Design Analysis		Hours
1.	List the types of road patterns adopted nearby and summarise the benefits and list out the solutions for existing problems.	02
2.	Select a real-world case study on Highway alignment, Geometric design aspects - curves, camber, sight distances and document it	06
3	Prepare a technical report with drawings, charts, and IRC references with reference to a case study	06
Total		**14**
ABL2 (13 Hours): Activity 2		**Hours**
1.	Conduct a field study on traffic volume and estimate the capacity of the road. Design a suitable type of pavement based on the vehicular data.	08
2.	Identify and classify different types of drainage structures according to soil conditions, and recommend appropriate remedial measures for their maintenance	05
Total		**13**

Evaluation of Learning Process (10 Hours)

Type of Evaluation	Hours
Test(1,2 and 3)	3
Quiz(1and 2)(optional)	1
Lab Test	3
Semester End Exam	3
Total	**10**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2	2										
CO2	3	2	2										
CO3	3	2	2									2	
CO4	3	2	2									2	

Course Title	ENVIRONMENTAL ENGINEERING LABORATORY		
Course Code	24CV505	**(L-T-P)C**	(0-0-2)1
Exam	3Hrs.	**Hours/Week**	02
SEE	100 marks	**Total Hours**	28P+2ABL=30

Course Objective: To familiarize students with standard procedures and techniques for the analysis of water and wastewater and to provide practical knowledge of sampling, preservation, and interpretation of environmental data

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

#	Course outcomes	Mapping to POs	Mapping to PSOs
1	Estimate the physical & general parameters concerning substances undesirable in excessive amounts for the suitability of water for drinking and construction purpose as per the specifications	PO1, PO4, PO6, PO8	—
2	Estimate the parameters of wastewaters for its suitability to discharge the environmental pollutants as per specifications	PO1, PO4, PO6, PO8	—

Sl No.,	Lab Exercises
1	Determination of Acidity
2	Determination of Alkalinity
3	Determination of Chlorides
4	Determination of Calcium, Magnesium and Total Hardness
5	Determination of Dissolved Oxygen
6	Determination of BOD
7	Determination of COD
8	Determination of percentage of available chlorine in bleaching powder, residual Chlorine and Chlorine Demand
9	Jar Test for Optimum Dosage of Alum – Turbidity determination by Nephelometer
10	Determination of Nitrates, Sulphates, iron and fluoride using Spectrophotometer
11	Determination of Solids in Sewage: Total Solids - Suspended Solids - Dissolved Solids - Volatile Solids - Fixed Solids – Settleable Solids.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Laboratory Manual for Environmental Engineering	N.N. Basak	2nd Edition	McGraw-Hill Education	2017
2	Environmental Engineering Laboratory Manual	M.R. Gidde	1st Edition	Laxmi Publications Pvt. Ltd.	2013
3	Standard Methods for the Examination of Water and Wastewater	APHA, AWWA, WEF	23rd Edition	APHA Press	2017

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Laboratory Manual for Environmental Chemistry	Sudha Goel	1st Edition	Cambridge University Press	2017
2	Environmental Engineering Laboratory Manual	Dr. S.K. Panigrahi, L. Mohanty	1st Edition	S.K. Kataria & Sons	2023

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	-	-	-
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1&ABL2)	-	-	02
6	Evaluation of Learning Process	-	-	-
Total Learning Hours/Semester				**30**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	One CIEs conducted for 20 marks	20
Activity Details	Evaluation of Lab Record	30
Total		**50**

Activity Based Learning (02 Hours)

ABL1 (01 Hour) : Activity 1 Details	Hours
Students shall collect water samples (tap, borewell, lake, wastewater) and analyze parameters for pH, turbidity, TDS, hardness, DO and alkalinity. Compare with Bureau of Indian Standards drinking water limits	**01**
Total	**01**
ABL2 (01 Hours): Activity 2 Details	**Hours**
Students shall analyze the water samples of various packaged drinking water for the mineral contents	01
Total	**01**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	7

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	1			3		2							
CO2	1			3		2							

Course Title	ENVIRONMENTAL STUDIES		
Course Code	24EVS	(L-T-P)C	(1-0-0) 1
Exam	03 Hrs.	Hours/Week	01
SEE	100 marks	Total Hours	14

Course Objective:

1. To create environmental awareness among the students.
2. To gain knowledge on different types of pollution in the environment

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Acquire an awareness of sensitivity to the total environment and its allied problems.	PO7, PO9	
2	Develop strong feelings of concern, sense of ethical responsibility for the environment and the motivation to act in protecting and improving it	PO6, PO8	
3	Analyze and evaluate environmental measures in real world situations in terms of ecological, political, economical, societal and aesthetic factors.	PO6, PO7, PO8, PO9	

MODULE-1	04 Hrs.

Environment: Definition, Ecosystem, Balanced ecosystem, Effects of human activities on environment Agriculture Housing Industry Mining and Transportation.

MODULE-2	03 Hrs.

Natural Resources: Water resources, Availability and Quality, Water borne diseases, Water induced diseases, Fluoride problem in drinking water. Mineral Resources - Forest Resources - Material Cycles - Carbon, Nitrogen and Sulphur Cycles.

MODULE-3	03 Hrs.

Pollution: Effects of pollution - Water pollution - Air pollution Land pollution - Noise pollution.

MODULE-4	04 Hrs.

Current Environmental issues of importance: Acid Rain, Ozone layer depletion - Population Growth, Climate change and Global warming. Environmental Impact Assessment and Sustainable Development Environmental Protection - Legal aspects. Water Act and Air Act.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Environmental Studies	Dr. D.L Manjunath	1st	Dorling Kindersley	2006
2	Environmental Studies	Dr. S. M. Prakash	3rd	Elite Publishers	2006

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Environmental Studies	Benny Joseph	3rd	Tata McGraw Hill	2017
2	Principles of Environmental Science and Engineering	P. Venugopala Rao	Revised	Prentice Hall of India	2012

EBooks and online course materials:

1. **https://www.ebookselibrary.com/book-detail/higher-education/arts/Environmental-Studies-1159**

Online Courses and Video Lectures:

1. https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 15 marks each (MCQ)	30
Activity Details	Activities to be conducted	20
Total		**50**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1							3		3				
CO2						3		3					
CO3						3	3	3	2				

Course Title	OCCUPATIONAL SAFETY AND HEALTH ASSESSMENT		
Course Code	24CV561	**(L-T-P)C**	(3-0-0) 3
Exam	03 Hrs.	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+48ABL= 90

Course Objective: Students will be able to recognize and evaluate occupational safety and health hazards in the workplace, and to determine appropriate hazard controls following the hierarchy of controls

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

#	Course outcomes	Mapping to POs	Mapping to PSOs
1	Identify hazards in the workplace that pose a danger or threat to their safety or health and understand the laws governing OSHA	PO1, PO6,	—
2	Analyze the standards and programs of ergonomics at workplace	PO1, PO6,	—
3	Analyze the concept of fire accidents and its early detection and methods of extinguishing fire	PO1, PO6,	—
4	Describe the role of health and safety in the workplace pertaining to the responsibilities of workers, managers and supervisors	PO1, PO6,	—

MODULE-1 — 10 Hrs.

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 – Types of accidents, causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

Theories Of Accidents: Domino, Human Factor, Petersen's Accident incident, Epidemiological, Human Error Model and Combination theory.

Self Study Component: Compare the safety standards of two industries (e.g., construction vs. IT). Study real-life examples of hazard control methods like PPE, ventilation systems, lockout/tagout, etc.

MODULE-2 — 10 Hrs.

Ergonomics at Workplace: Ergonomics Task analysis, Preventing Ergonomic Hazards, Workspace Envelops, Visual Ergonomics, Ergonomic Standards and Ergonomic Programs.

Hazard cognition and Analysis: Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations. Hazards and their Control in Pharmaceutical, construction, Textiles, Petroleum Refineries and LPG Bottling, Iron & Steel Industries.

Self Study Component: Prepare a report on major hazards and control measures in any two industry and Compare safety standards and preventive strategies across selected industries
MODULE-3 **10 Hrs.**
Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Technical Requirements of safety - Electrical Safety and Product Safety **Health Considerations at Work Place:** types of diseases and their spread, Health Emergency. ***Self Study Component: Prepare a visual chart of fire classes vs. fire extinguishers.***
MODULE-4 **10 Hrs.**
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 **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. Policies, roles and responsibilities of workers, managers and supervisors ***Self-Study: students shall visit nearby industry and study the policy and regulations followed by the respective industry and make a report on safety precautions adopted by the industry***

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Occupational Safety and Health for Technologists, Engineers, and Managers	David L. Goetsch	8th Edition	Pearson Education	2019
2	Safety and Health for Engineers	Roger L. Brauer	3rd Edition	Wiley-Interscience	2016

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Occupational Safety and Health	Mark A. Friend, James P. Kohn	6th Edition	Government Institutes / Bernan Press	2018
2	Handbook of Occupational Safety and Health	Danuta Koradecka (Ed.)	2nd Edition	CRC Press / Taylor & Francis	2010

EBooks and online course materials:

1. https://libraryguides.mcgill.ca/c.php?g=360379&p=2433815

Online Courses and Video Lectures:

1. **Industrial Safety and Fire Safety Management. Dr. P.K.Ghosh & Mrs.Annapurna Adiley, Chhattisgarh Swami Vivekanand Technical University (CSVTU), Bhilai**

https://onlinecourses.swayam2.ac.in/nou24_ge81/preview

2. **Industrial Safety Engineering By Prof. Jhareswar Maiti | IIT Kharagpur**

https://onlinecourses.nptel.ac.in/noc24_mg110/preview

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Group Activity - Field visit and report submission 2. Quiz	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (25 Hours): Field Visit and Report Submission - Group Activity		**Hours**
1.	Identify at least 10 potential hazards in the workplace and Suggest control measures using Hierarchy of Controls	05
2	analyze real industrial accident cases (construction accident, fire accident, chemical exposure etc.). Identify: immediate causes, Root causes and Unsafe acts and conditions	05
3	analyze ergonomic issues in: Computer labs and Classrooms. Evaluate posture, workspace layout, lighting	05
4	study Personal Protective Equipment used in the Construction industry and Wastewater treatment plants. Prepare a PPE safety audit checklist	05
5	conduct a safety inspection of the college campus (laboratories, workshops, electrical rooms, staircases, hostels). Identify unsafe conditions such as: Exposed electrical wiring, slippery floors, Blocked emergency exits and Absence of fire extinguishers	05
Total		25
ABL2 (02 Hours): Activity 2 Details		**Hours**
1	Assignment	01
2	Quiz	01
Total		02

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Quiz (1and 2) (optional)	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2					3							
CO2	3					2							
CO3	2					3							
CO4	3					2							

Course Title	REMOTE SENSING AND GIS		
Course Code	24CV562	**(L-T-P) C**	(3-0-0) 3
Exam	03 Hrs.	**Hours/Week**	03
SEE	50 marks	**Total Hours**	42L+48ABL= 90

Course Objective: To develop Knowledge on RS and GIS technologies to collect analyze and interpret spatial data for solving real life problems

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

#	Course outcomes	Mapping to POs	Mapping to PSOs
1	Comprehending remote sensing entails understanding of Energy interactions	PO1,P02	
2	Applying remote sensing in data collection and analysis through different types of sensors & platforms	PO1,P02	
3	Comprehend GIS : Managing , Analyzing ,Visualizing spatial data solutions	PO1,P02	
4	Develop a comprehensive report on different types of currently working satellites and their uses	P09, PO10	

MODULE-1	**10 Hrs.**

Introduction: Basics of Remote Sensing, Active and Passive Remote sensing (RS), Scope of remote sensing; Electromagnetic radiation and electromagnetic spectrum: Visible, Infra-Red (IR), Near IR, Middle IR, Thermal IR, and Microwave. Black body radiation and radiation laws; Interaction of EMR with atmosphere and Earth's surface features.

Types of Remote Sensing and Sensors Characteristics Platform and Orbits: Ground Based, Air Borne, Space borne. Orbits: Geo-Stationary satellite, Polar Orbiting satellite. Types & characteristics of sensors, Sensor resolution, Concept of Swath and Nadir,Remote sensing data products: IRS, LANDSAT, SPOT, IKONOS, Quick Bird

Self - study component: Students shall collect the information on space research organizational structure ,Types of Indian satellites, and data products

MODULE-2	**10 Hrs.**

Thermal Remote Sensing; Thermal properties of materials:
Emissivity of materials; thermal inertia of Earth surface features; Thermal data sets: LANDSAT and ASTER; Concept and Principles of microwave remote sensing; Microwave data sets SLAR, LIDAR and SAR;

Application of Thermal and Microwave data;
Digital Image processing: Introduction to Image, Digital image Types of Data Products, Types of image interpretation, Basic elements of image interpretation, Visual interpretation keys, Digital Image Processing, Preprocessing, image enhancement techniques, multispectral image classification, Supervised and unsupervised.

Self-study component: Students shall collect the information on commercial and open-source Remote Sensing data for use in GIS. Download free DEM and LULC data.

MODULE-3	**10 Hrs.**

Introduction to GIS:
Fundamentals of Geographic Information System: Basic Concepts: definition of GIS, Components of GIS, Variables - points, lines, polygon, Functionality of GIS, Recent trends and applications of GIS; GIS Softwares, Open-source GIS;

GIS Database: Geographic data: Spatial and non-spatial; Data models: Raster and vector; Database Management System (DBMS): Geo-database. Data Structures: Relational, hierarchical and network; Digitization of maps and imageries, Attribute data generation; Data Editing: Coordinate systems, Coordinate transformation.

Self-study component: Students shall collect the information on different commercial and open-source GISsoftware

MODULE-4	**10 Hrs.**

Integrated Applications of Remote sensing and GIS
Applications in land use land cover analysis , Change detection , Water resources , Urban planning, environmental planning, Natural resource management and Traffic Management , Location based services and its applications.
Introduction to Global Positioning System (GPS): GPS satellites constellations; GPS segments: Space, Control, User; GPS antennas, signals, and codes; GPS receivers; Modes of measurements and post processing of data; Accuracy of GPS measurements; Application of GPS.

Self-study component: Students shall collect the information on different GPS systems in the world and their working.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Remote Sensing and Image Interpretation	Lillesand, Kiefer, Chipman,	7th	Wiley	2022
2	Remote sensing and GIS	Basudeb Bhatta	3rd	Oxford University Press	2021
3	Geographical Information Science	Narayan Panigrah	1st	University Press	2009
4	Introduction to Geographic Information System	Kang – T surg Chang,	4th	Tata McGraw Hill Education Private Limited	2017

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Remote sensing and Geographical information system	Anji Reddy M.	2	B. S. Publications	2008
2	Basics of remote sensing & GIS	S Kumar,	1st edition	Laxmi publications	2016
3	Remote sensing of the environment	John R. Jensen,	2nd	Pearson Education	2013

EBooks and online course materials:

1. **https://science.iirs.gov.in/wp-content/uploads/2024/09/Overview_of_Remote_Sensing_and_GIS_Applications_E-Book.pdf**
2. **https://www.gisresources.com/wp-content/uploads/2013/09/anji-reddy_GIS.pdf**

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc22_ce84/preview
2. https://archive.nptel.ac.in/courses/105/103/105103193/
3. https://www.iirs.gov.in/pgdiploma

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Details of activity : **Analysis of Remote Sensing Data Sets**: Students explore and write about various types of remote sensing data sets (e.g., optical, microwave, thermal) and their applications, discussing the advantages and limitations of each. 2. Details of activity 2 : **GIS Theory and Case Study Presentation**: Students write a detailed case study on how GIS is used in real-world scenarios (e.g., environmental monitoring, urban planning) and present their findings	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Study of optical, microwave, and thermal datasets with basic concepts	5
2	Comparison of datasets based on applications, advantages, and limitations	5
3	Report writing & Discussion	4
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Introduction to GIS and selection of case study topic	4
2	Detailed study and preparation of case report	5
3	Presentation of findings and feedback	4
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2											
CO2	3	2											
CO3	3	2											
CO4									3	2			

Course Title	GROUNDWATER DEVELOPMENT AND MANAGEMENT		
Course Code	24CV563	**(L-T-P)C**	(3-0-0)3
Exam	03 Hrs.	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+48ABL=90

Course Objective: Learn basic fundamentals of groundwater flow, storage and yield. 2. Learn various methods of well development. The concepts of groundwater basin management, conjunctive use, competing demands, recharge and mining will add in equipping students to take better decisions in groundwater management.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Distinguish various aquifer properties to be used in the differential flow equations of the groundwater.	PO1	
2	Apply the knowledge to estimate various surface and subsurface investigations to be used in the groundwater explorations	PO1	
3	Analyze the various recharge methods and effective basin management	PO2	
4	Examine the various components of groundwater recharge methods through field visit and communicate and report the need for and importance of them	PO6, PO11	

MODULE-1	**10 Hrs.**

Groundwater Occurrence and Movement: Groundwater hydrologic cycle, origin of groundwater, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention. Percolation, Permeability, Darcy's law, storage coefficient, Transmissivity, differential equation governing groundwater flow in three dimensions - derivation, Line of Saturation, Phreatic Surface and Phreatic line.

Self-study component: Groundwater Flow Contours and their applications

MODULE-2	**10 Hrs.**

Surface And Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications

Self-study component: Case studies in Subsurface Investigation

MODULE-3	**10 Hrs.**

Artificial Recharge of Groundwater: Concept of groundwater recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Recharge of Groundwater along with Case studies.

Self-study component: Case Studies on Artificial Recharge of Groundwater

MODULE-4	**10 Hrs.**

Groundwater Basin Management: Groundwater basin management concept, hydrologic equilibrium equation, groundwater basin investigations, data collection & fieldwork, dynamic equilibrium in natural aquifers, management potential & safe yield of aquifers, stream-aquifer interaction

Self-study component: Explore the concept of conjunctive use and its implications for water resource management.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Groundwater Hydrology	David Keith Todd and Larry W. Mays	3rd Edition,	JOHN WIELY	2004
2	Ground Water	H. M. Raghunath	3rd Edition,	New Age International Publications	2007

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Groundwater Hydrology	B.R.Chahar	8th Edition,	McGraw Hill Education,	2015
2	Groundwater System Planning & Management	R.Willes&W.W.G.Yeh	Revised	Prentice Hall of India,	2001

EBooks and online course materials:

1. https://link.springer.com/book/10.1007/978-3-319-75115-3

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc22_ce44/preview

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Explore the applications of GIS and Remote Sensing in Groundwater Recharge. 2. Examine the various components of groundwater recharge methods through field visit and communicate and report the need for and importance of them	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Select any one case study to explore the application of GIS and Remote sensing in Groundwater Recharge	3
2	Summarize the objective, methodology and outcomes in the case study for identifying groundwater recharge zones	8
3	Document the above with necessary supporting articles and images	3
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Examine the various components of groundwater recharge methods through field visit	5
2	Document the existing recharge techniques if any and report the existing crop cultivation technique	5
	Communicate and report the need for, importance of them and also suggest the suitable Recharge technique	3
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2												
CO2	3												
CO3		3											
CO4						2					2		

Course Title	REPAIR AND REHABILITATION OF STRUCTURES		
Course Code	24CV564	**(L-T-P)C**	(3-0-0)3
Exam	03 Hrs	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+48ABL=90

Course Objective:

1. Investigate the cause of deterioration of concrete structures.
2. Strategies different repair and rehabilitation of structures

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Identify the causes for structural (Concrete) deterioration	PO1	
2	Analyze the type and extent of damage and carry out damage assessment of structures through various types of tests	PO2	
3	Analyze the maintenance requirements of the buildings and preventive measures against influencing factors.	PO2	
4	Prepare a comprehensive report on deterioration of structural elements of the building	PO8, PO9	

MODULE-1	**10 Hrs.**

Introduction: Definition of Repair, Retrofitting, and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake and natural disaster. Diagnostic devices for investigation and distress assessment. Special Mortars and concrete. Protective Coatings, Epoxy Bonding Agents

Self-study component: Students have to visit rehabilitation site and submit a report

MODULE-2	**10 Hrs..**

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, nondestructive and semi destructive testing methods.. Pullout Test, Carbonation , Chloride Penetration test .

Self-study component: Students have to visit concrete lab and perform NDT on sample specimen.

MODULE-3	**10 Hrs..**

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Factors affecting Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post- tensioning, guidelines for seismic retrofitting of existing building.

Self-study component: Students have to collect information of jacketing technique in retrofitting

MODULE-4	**10 Hrs.**

Materials for Repair and Retrofitting: Artificial fiber reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, dry pack mortar and concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Self study component : Students have to visit site to visualize artificial FRPS and submit a report

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Concrete Structures Repair Rehabilitation	BHATTACHARJEE J	1st Edition	CBS	2019
2	Repair and Rehabilitation of Structures and Retrofitting	Dr R N Krishna (Author), Prof. A R Santhakumar	1st edition	STANDARD BOOK HOUSE SINCE 1960	2022

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Repair of Concrete Structures	R.T.Allen and S.C. Edwards	1st edition	-Blakie and Sons	2019
2	Learning from Failure in the Design Process Experimenting with Materials	Lisa Huang	1st Edition	Taylor & Francis	2020

EBooks and online course materials:

1. **https://theconstructor.org/wp-content/uploads/2016/09/handbook-rrs.pdf**
2. **https://www.scribd.com/document/625159318/Repair-and-Rehabilitation-of-Concrete-Structures-by-Dr-b-Vidivelli**

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/105106202
2. https://nptel.ac.in/courses/archive.nptel.ac.in/courses/105/105/105105213/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1.Examine the various components of a building under failure through field visit and communicate and report the need for repair and retrofitting. 2. Regular short quizzes conducted for each module for understanding of the most recent concepts.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Prepare simple concrete cubes with high-w/c and low-w/c; compare crack patterns and strength.	9 hrs
2	Students perform non-destructive tests (NDT), compare rebound numbers for surface hardness of various blocks in institute	5 hrs
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Teams assess a "damaged" beam, applying full procedure—visual inspection, NDT . They prepare reports with recommendations, presented as if to a consultancy client	10 hrs
2	Students audit a mock building to identify factors like corrosion or weathering using checklists for material degradation, weathering exposure, and usage loads	3 hrs
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3												
CO2		2											
CO3		3											
CO4								3	2				

Course Title	STABILITY ANALYSIS OF SLOPES AND DEEP EXCAVATION		
Course Code	24CV565	**(L-T-P)C**	(3-0-0)3
Exam	03 Hrs	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+48ABL=90

Course Objective: To equip students with the knowledge and skills to assess the stability of slopes and to design safe and reliable structures.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Classify slope failures and explain failure mechanisms using geological data	PO1, PO2	
2	Analyze seepage and slope stability using analytical and graphical methods	PO1, PO5	
3	Assess rock slope failures and recommend suitable stabilization techniques.	PO2, PO3	
4	Conduct site-based or model-based investigations and present technical findings.	PO4, PO10	

MODULE-1	**10 Hrs.**

Introduction: Introduction, classification of natural slopes and excavation failures, slope stability – mechanics of slope failure, failure modes. Collection and analysis of geological data, field survey and testing, graphical presentation of geological data and evaluation of potential slope problems.

Self study component: Students shall visit any site investigate the natural slopes and prepare a report on it.

MODULE-2	**10 Hrs.**

Seepage analysis: in-situ permeability tests, two dimensional flow – Laplace equation and it's solution, graphical method, determination of phreatic line, flow nets in homogeneous and zoned earth dams. Soil slopes, infinite slope, method of slices, friction circle methods etc., Bishop's modified method, Bishop's rigorous method, Janbu's method, Morgenstern and Price, Spencer's method, stability analysis of dam body during steady seepage.

Self study component: Student shall develop a numerical model for seepage analysis of Gorur dam Hassan

MODULE-3	10 Hrs.

Rock slopes: methods of slope stability analysis, plane failure, wedge failure, over toppling failure, Hoek & Bray's charts, three dimensional wedge analysis seismic considerations, computer programs, use of non-linear failure criterion in rock slope stability analysis.

Strengthening & stabilization of slopes: Strengthening measures, stabilization of slopes by drainage methods, surface and subsurface drainage, use of synthetic filters, retaining walls, stabilization and strengthening of slopes, shotcreting, rock bolting and rock anchoring.

Self study component: Students shall design & develop reinforcement for rock slopes near.

MODULE-4	10 Hrs.

Deep Excavation: Introduction to the analysis and design of excavations - Geological investigation and soil tests, Conditions of the adjacent properties, Confirmation of the conditions of an excavation site, Designing criteria, Excavation analyses, Protection of neighboring properties

Excavation methods and lateral supporting system: Introduction, Excavation methods like full open cut methods, Braced, anchored, island Methods, sheet piles, column piles, diaphragm walls, strutting system.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Geotechnical Slope Analysis	Chowdhary Robin and Chowdhary Indrajit	2nd Edition	CRC Press.	31 December 2023
2.	Rock Slope Engineering	Hoek, E. and Bray, J.W.,	4th Edition	CRC Press.	2005
3.	Deep Excavation Theory and Practice	Chang-Yu Ou		Taylor & Francis.	

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Software for Engineering Control of Landslides and Tunneling Hazards	Singh, B. and Goel, R.K.,	1st Edition	A A Balkema Publishers	1 January 2002
2.	Rock Slope Engineering	Wyllie Duncan C and Christofer W Mah,	4th edition	Spon Press	2004

EBooks and online course materials:

1. Rock Slope Engineering
2. ROCK SLOPE STABILITY ANALYSIS

Online Courses and Video Lectures:

1. Slope Engineering
2. Soil Mechanics/Geotechnical Engineering I

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Presentation - 10Marks 2. Site visit and report on it - 10Marks	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	**Field Visit to Natural or Man-made Slope** (Hill slope, road cutting, quarry slope, or dam embankment near Hassan such as Gorur dam region). Students identify slope types, failure indicators (cracks, erosion, seepage).	8
2	**Geological Data Collection and Slope Mapping** – Students collect field data such as slope angle, soil/rock type, groundwater seepage conditions, discontinuities and prepare graphical representation of geological data.	6
Total		**14**

ABL2 (13 Hours): Activity 2 Details		Hours
1	**Seepage Analysis Modeling** – Students develop a numerical or graphical seepage model for **Gorur Dam, Hassan**, determine phreatic line and flow net using software or graphical method.	5
2	**Rock Slope Failure Case Study** – Students analyze a case study of rock slope failure and identify the type of failure (plane, wedge or toppling) using Hoek & Bray charts.	4
3	**Design of Slope Stabilization Measures** – Students design suitable stabilization techniques such as rock bolting, drainage systems, retaining walls or shotcreting and present findings.	4
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2	3											
CO2	2	3											
CO3			3										
CO4			2	3									

Course Title	ENVIRONMENTAL IMPACT ASSESSMENT		
Course Code	24CV566	**(L-T-P)C**	(3-0-0) 3
Exam	03 Hrs.	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+48ABL=90

Course Objective:
To provide comprehensive understanding of the principles, methodologies, and practices involved in assessing the environmental consequences of proposed projects or policies.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply the concepts and regulatory framework of Environmental Impact Assessment including guidelines of Ministry of Environment, Forest and Climate Change for siting of industries.	PO1, PO6, PO7	
2	Acquire proficiency in various methodologies, techniques, and tools used in conducting EIA	PO1, PO6, PO7	
3	Analyze environmental attributes such as air, water, land, noise, biodiversity and socio-economic aspects to determine environmental impact significance.	PO1, PO7	
4	Analyze the EIA process including preparation of EIS, FONSI, Environmental Management Plan (EMP), Disaster Management Plan (DMP), public participation, and environmental auditing for major industrial and infrastructure projects.	PO6, PO7	

MODULE-1	**10 Hrs.**

EIA: Definitions, Purpose of EIA, Scope of EIA, Hierarchy in ElA. EIA as practiced in India and other countries. MOEF guidelines on siting of industries. Framework of Impact assessment. Relationship between EIA,EIS and Fonsi

The EIA process, Contents of EIA, EIS, FONSI. Environmental Management Plan (EMP) and Disaster Management Plan (DMP).

Self-study component: Download the document of an EIA Case Studies and Best Practices, submit a report.

MODULE-2	10 Hrs.
Methodologies & Techniques in EIA: Adhoc, checklist, matrix (attribute activity relationship), overlays, networks, BEES, Techniques in EIA –brainstorming, fuzzy, CBA, Delphi technique, EIA Models. ***Self-study component: Download the document of an Environmental Monitoring and Assessment, submit a report.***	
MODULE-3	**10 Hrs.**
Environmental Attributes: Air, water, land, sound, Socio economic aspects and biodiversity. Standards and Value functions-Graphs and interpretations-Impact significance. **Public participation in EIA:** Need, objectives, elements and framework for public participation – step by step procedure. ***Self-study component: Download the document of a Case Studies and Practical Applications, submit a report.***	
MODULE-4	**10 Hrs.**
EIA audit–Types and auditing procedure, Detailed EIA for Red category industries Pharmaceuticals, Power Plants, Mining, Pulp and paper mills, distilleries. Construction Projects, Airports, MRTS, MSW/HSW projects. Water and Wastewater Treatment facilities, mega desalination projects. ***Self-study component: Students shall visit Industries and study the Quality Assurance and Quality Control (QA/QC), submit a report.***	

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Environmental Impact Assessment	Anjaneyulu and Valli Manickam	2nd	BS Publications	2010
2	Environmental Impact Assessment	V S Kulkarni, S N Paul	Revised	Scientific publisher	2019

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Environmental Impact Assessment	Larry Canter	2nd	Mc Graw Hill Publishers	2007
2	Environmental Impact Assessment	Judith Petts	Revised	Blackwell Science	2010

Online Courses and Video Lectures:

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

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Group Activity Quiz	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Students download EIA reports from official sources like the Ministry of Environment, Forest and Climate Change (MoEFCC), environmental journals, or government portals.	8
2	Students are hereby informed to make a report	6
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Detailed reading of selected EIA reports such as power plant, highway project, mining project, etc., to understand environmental impacts and mitigation measures.	5
2	Identify good practices such as public participation, sustainable mitigation measures, monitoring plans, and environmental management strategies used in the case studies.	5
	Students summarize the case studies including project description, environmental impacts, mitigation measures, and conclusions.	3
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3					2	2						
CO2	3					2	2						
CO3	3					2	2						
CO4	3					2	2						

Course Title	Traffic Engineering, Road Safety and Management		
Course Code	24CV567	(L-T-P)C	(3-0-0)3
Exam	03 Hrs	Hours/Week	3
SEE	100 Marks	Total Hours	42L+48ABL=90

Course Objective: Develop understanding about different components of the hydrological cycle Enable the students to estimate runoff, infiltration, evaporation, groundwater flow and peak floods.
Course Outcomes: At the end of course, student will be able to:

#	Course Outcomes	Mapping to POs	Mappig to PSO's
1	Identify the characteristics of traffic engineering & to evaluate the feasibility of road by using traffic volume studies & speed studies	PO1, PO2, PO3	
2	Categorize the road based on LOS and to judge road safety by analyzing accident studies.	PO1, PO2	
3	Evaluate the arrival pattern of vehicles by traffic flow theories and to develop statistical techniques for minimizing congestion.	PO1, PO2, PO3	
4	Apply road safety awareness for social and professional responsibility	PO6, PO7, PO8, PO9, PO10, PO12	

MODULE-1	10 Hrs.

Scope of Traffic Engineering: Objectives and scope of traffic engineering, components of road traffic - the vehicle, driver and road, road user characteristics – factors governing, vehicular characteristics, power performance of the vehicle, concepts of passenger car units for mixed traffic flow. Traffic Engineering Studies and Analysis: Sampling in Traffic Studies, methods of traffic study, equipment, data collection, analysis and interpretation of (i) Spot speed (ii) Speed and delay (iii) Volume (iv) Origin - Destination (v) Parking studies.

Self-study component: Students shall visit the local Traffic control office and discuss the traffic problems and vehicular characteristics and shall calculate the instantaneous speed of the vehicle.

MODULE-2	10 Hrs..

Traffic capacity studies: Basic capacity, Possible capacity, Practical capacity, LOS concept, Factors affecting capacity & LOS, Capacity of multilane rural highways, urban streets & signalised intersections. Crash Studies: Objectives – causes – records – preparation of accident report – Condition diagram – Collision diagram – Accident investigations. Analysis of individual traffic accidents – Analysis of speed from skid resistance – Collision of moving vehicle with parked vehicle – Two vehicles approaching at right angles collide–Numerical examples, Measures for reduction in accident rates.

Self-study component: Students shall collect information on traffic volume, traffic density, causes of accidents, and measures for reduction of accidents from the local traffic control office.

MODULE-3	**10 Hrs..**

Traffic Flow Theories: Definition – relationship between speed, flow and concentration – Fundamental diagram of traffic flow. Statistical Analysis: Importance, various statistical methods - Regression methods, Poisson distribution, use of chi – squared test, numerical examples on these methods. Traffic Signals – advantages, types, Principles of signal design - Webster method. ITS in Urban Traffic: Intelligent Transport System, Necessities, Application in the present traffic scenario.

Self-study component: Students shall study the applications of different probability distributions to traffic problems.

MODULE-4	**10 Hrs.**

Road Safety Measures and Management Strategies: Engineering measures: road signs, markings, signals, and basic road design considerations for safety. Enforcement measures: traffic rules, regulations, and penalties. Education measures: awareness programs and road safety campaigns. Role of institutions and policies in road safety management and implementation strategies.

Self-study component: *Students will design and present a road safety awareness activity such as posters, presentations, or short videos focusing on key safety issues like helmet use, seat belt usage, and pedestrian safety.*

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Traffic Engineering and Transportation Planning	L. R. Kadiyali	4th	Khanna Publishers	2019
2	Transportation Engineering	C. Jotin Khisty, B. Kent Lall	3rd	Pearson	2018

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Road Safety Engineering	David W. E. Davies	4th	Thomas Telford Publishing	2010
2	Traffic Engineering	Roger P. Roess, Elena S. Prassas, William R. McShane	5th	Pearson	2019

EBooks and online course materials:

1. https://nptel.ac.in/courses/105101008

Online Courses and Video Lectures:

1. http://www.digimat.in/nptel/courses/video/128106143/L01.html

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Activities to be conducted	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Students must perform the activity in assigned groups. All members must actively participate in the field work.	8
2	Conduct Spot Speed Study, Traffic Volume Study, and LOS analysis. Minimum observation time: 30–60 minutes.	6
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
	Data Compilation, Validation, Analysis: Spot Speed: Record speeds and prepare frequency distribution, cumulative curve, and percentile speeds (15th, 50th, 85th). Traffic Volume: Count and classify vehicles; convert to PCU/hr. Calculate Speed, Flow, and Density. Determine LOS (A–F) based on observations.	8
	Presentation, Report Writing and Review: Group presentation of findings, discussion of speed, volume, capacity and recommendations.	5
Total		**13**

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3		1	1	2								
CO2	1	2	1	3									
CO3	3	2	1										
CO4	1	2	2										

Course Title	THEORY OF ELASTICITY		
Course Code	24CV568	**(L-T-P)C**	(3-0-0)3
Exam	3 Hrs.	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: To impart knowledge of mathematical techniques for analyzing the structures
Course Outcomes: At the end of course, student will be able to,

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Formulate the differential equations of equilibrium and boundary conditions, mathematical representation of stresses and strains at a point.	PO1,PO2, PO3	
2	Analyze strains, strain rosettes, compatibility equation	PO1,PO2, PO3	
3	Formulate Airy's stress function, 2D problems in rectangular coordinates under different loading conditions.	PO1,PO2, PO3	
4	Analyze the basic equations of elasticity in the polar coordinate system the stress distribution under axi-symmetric loading in thick discs	PO1,PO2, PO3	

MODULE-1	**10 Hrs.**

Introduction to Mathematical theory of elasticity – Definition of Continuum – Stress and strain at a point – Constitutive laws – Generalized Hooke's law – Strain - displacement relations. Analysis of Stress: Introduction – differential equations of equilibrium – Boundary conditions – Principal stresses and principal Planes –Mohr's Circle.

MODULE-2	**10 Hrs..**

Analysis of Strain: Introduction –Plane stress and Plane strain–Principal planes–measurement of surface strains – Strain rosettes – Compatibility concept – need and physical significance – Compatibility equation in terms of strains.

MODULE-3	**10 Hrs..**

Two-dimensional Problems in Rectangular Coordinates –compatibility equations for plane stress and plane strain cases – Airy's stress function – Polynomial stress functions. Bending of a cantilever beam subjected to end load and u.d.l – Simply supported beam subjected to UDL – Displacements in Cantilever and S.S.Beams

MODULE-4	**10 Hrs.**

Two dimensional problems in polar coordinates: Strain-displacement relations – Equations of equilibrium–Compatibility equation–Stress-function. Axi symmetric problems–Thick discs and cylinders – Rotating discs and cylinders. Effect of Circular Holes on Stress Distribution in Plates- Subjected to Tension, compression and shear – Stress concentration factor.

Self- study component: *Students shall revise differential calculus and the significance of differential equations, Hooke's Law, elastic constants, stress and strain relations stress - strain relations, beam bending theory, bending stresses from basic strength of materials*

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Theory of Elasticity	Timoshenko S.P and Goodier J.N	2007	Tata Mc Graw-Hil	2015
2.	Theory of Elasticity	Sadhu Singh	2007	Khanna Publishers	2015

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/105/105/105105177/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted Details of activity 1 - Students shall carry out the activity as mentioned in the self study component and submit a report. Details of activity 2 - Quiz and Assignment	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Conduct experiments to learn relationship between stress and strain,Concept of **Hooke's Law,**Elastic vs plastic behavior	07
2	Using graph paper or software to construct stress circles to understand**,** Principal stresses, Maximum shear stress,Stress transformation	07
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Conduct experiments by applying load at the center of simply supported beams and observe deflection, visualize bending moment and curvature	07
2	Twist a cylindrical object to learn Shear stress distribution, Angle of twist, Torsional rigidity	06
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**2**	**3**		**1**									
CO2	**2**	**3**		**1**									
CO3	**2**	**3**		**1**									
CO4	**2**	**3**		**1**									

Course Title	RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS		
Course Code	24RIP	**(L-T-P)C**	(3-0-0) 3
Exam	3 Hrs.	**Hours/Week**	03
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: To give an overview of technical research activities and patenting methodology.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Carry out Literature Review and write technical paper	PO2, PO3, PO4, PO8, PO12	
2	Describe the fundamentals of patent laws and the patent drafting procedure	PO6, PO8, PO10,PO12	
3	Elucidate the copyright laws and subject matters of copyright	PO6, PO8, PO10, PO12	

MODULE-1	**10 Hrs.**

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research.

Ethics in Engineering Research: Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art, Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward, Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading.

MODULE-2	**10 Hrs.**

Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, acknowledgments and Attributions.

Technical Writing and Publishing: Free Writing and Mining for Ideas, Attributes and Reasons of Technical Writing, Patent or Technical Paper?—The Choice, Writing, Journal Paper: Structure and Approach: Title, Abstract, and Introduction, Methods, Results, and Discussions, Table, Figures, Acknowledgments, and Closures

MODULE-3	**10 Hrs.**

Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP, Major Amendments in IP Laws and Acts in India.

Patents: Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. NonPatentable Matters. Patent Infringements.

Process of Patenting: Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Do I Need First to File a Patent in India. Patent Related Forms. Fee Structure. Types of Patent Applications.

MODULE-4	**10 Hrs.**

Copyrights and Related Rights:

Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC).

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration.

Self-study: Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, IP Organizations In India.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Engineering Research Methodology	Dipankar Deb, Rajeeb Dey, Valentina E, Balas.	1st	Springer	2019
2	Intellectual Property	Prof. Rupinder Tewari, Ms. Mamta Bhardwa	1st	Professor Gurpal Singh Sandhu Honorary Director, Publication Bureau, Panjab University	2021

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Research Methods for Engineers	David V. Thiel	1st	Cambridge University Press	2014
2	Intellectual Property Rights	N.K.Acharya	8th Edition	Asia Law House,	2021

EBooks and online course materials:

1. **https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview**

Online Courses and Video Lectures:

4. **https://youtu.be/E2gGF1rburw**

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Activities to be conducted	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Collect literatures related to recent trends in Civil Engineering	8
2	Prepare a report on review of the literatures collected	6
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Visit IPO website and collect information about recent patents	7
2	Visit Copyright website and collect information about recent copyrights	6
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**	
CO1		3	2	3				2				3		
CO2						3		2		3		3		
CO3						3		2		3		3		

Course Title	DESIGN AND DETAILING OF RC STRUCTURES		
Course Code	24CV601	**(L-T-P)C**	(3 - 0 - 2) 4
Exam	3 Hrs	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+28P+50ABL=120

Course Objective: To understand and gain knowledge to build a structure that can effectively withstand the internal loads and meet the requirements.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Limit state philosophy related to flexure, shear, bond, torsion and analysis of singly and doubly reinforced rectangular sections, as per the provisions of IS 456- 2000 in limit state of flexure	PO1, PO2	-
2	Examine the mechanism of RC sections in the limit state of serviceability in deflection and cracking and design of beams as per IS:456-2000	PO2, PO3	-
3	Design the limit state of compression members – short columns and also design of slabs as per IS:456-2000	PO2, PO3	-
4	Design the various types of footings and staircase as per IS:456- 2000	PO3, PO6	-

MODULE-1 — 10 Hrs.

General Features of Reinforced Concrete- Introduction–Design loads–Materials for reinforced concrete –Code requirements for concrete reinforcements –Elastic theory of RC section –Moment of resistance of sections –Balanced, under reinforced and over reinforced sections.

Principles of Limit State Design and Ultimate Strength RC Section – Philosophy of limit state design – Concept of limit states – Factor of safety – Characteristic and design loads – Characteristic and design strength–General aspects of ultimate strength–Stress block parameters for limit state of collapse. Limit state of flexural strength of singly and doubly reinforced rectangular sections. Limit state of flexural strength of flanged sections. Limit state of shear strength of RC sections. Concepts of bond, development length and anchorage–Examples on analysis of rectangular and flanged RC sections. Durability requirements, minimum Grade of concrete for design as per IS:456, reinforcement cover requirements and detailing.

Self-study component: Students shall visit ongoing construction project sites to observe the casting of RC components.

MODULE-2	10 Hrs.

Serviceability Limit State – General and durability aspects–Deflection limits in IS: 456-2000 – calculation of deflection (Theoretical method) – Cracking in structural concrete members- Calculation of deflections and crack width as per IS:456-2000.

Design of Beams – Practical requirements of an RCC beam – size of the beam – Cover to the reinforcement – Spacing of bars – Design procedure – Critical sections for moments and shear – Anchorage of bars: check for development length –Reinforcement requirements –Slenderness limits for beams to ensure lateral stability – Design examples for simply supported beams and cantilever beams- singly and doubly reinforced.

Self-study component: Students shall visit an ongoing construction project site to observe the design and detailing of RC beam.

MODULE-3	10 Hrs.

Design of Slabs – Introduction – General consideration of design of slabs –deflection criteria- rectangular slabs spanning in one direction – Rectangular slabs spanning in two directions for various boundary conditions – Design of simply supported slabs – cantilever slabs and continuous slabs- one way and two-way. **Design of Columns** – General aspects –restraints and boundary conditions- Effective length – Loads on columns – Slenderness limits for columns – Minimum eccentricity – Design of short axially loaded columns – Design of column subjected to combined axial load and uniaxial moment using SP16.

Self-study component: Students shall visit an ongoing construction project site to observe the design and detailing of RC slabs and columns.

MODULE-4	10 Hrs.

Design of Footings – Introduction – Load on foundation –Design of isolated rectangular footing for axial load, eccentric, uniaxial moment–Design of pedestal. **Design of Stair Case** –General features – Types of Staircases–Loads on staircases –Effective span as per IS 456-2000.–Distribution of loading on stairs–Design of dog-legged staircases.

Self-study component: Students shall visit an ongoing construction project site to observe detailing of RC footing and staircase.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Design of Reinforced Concrete Structures	Krishna Raju N	2011	CBS Publishers and Distributors	2011
2	Limit State Design of Reinforced Concrete	Varghese P.C	2008	Laxmi Publications	2013

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Reinforced Concrete Design	Ashok Kumar Jain and Arun Kumar Jain	10th	Lakshmi Publications	2018
2	Reinforced Concrete Design	S.Unnikrishna Pillai	4th	TMH	2021

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/105/105/105105105

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	2	14	28
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1&ABL2)	-	-	26
6	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**120**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Two activities will be conducted	20
Total		**50**

Laboratory Plan :

Lab Program	Program Details
1	Singly Reinforced Beams C/S Doubly Reinforced Beam C/S (NOTE: Drawings to be prepared for given structural details. Also Bar Bending Schedule should be prepared for above beams using drafting software) **7 Hrs**
2	Singly Reinforced Beams L/S and C/S Doubly Reinforced Beam L/S and C/S Flanged Beam L/S and C/S. Beams–Simply supported, Cantilever and Continuous. (NOTE: Drawings to be prepared for given structural details. Also, bar bending schedule should be prepared for above beams) **7 Hrs**
3	Slab–One way,Two way and One way continuous slab Column (Square and Rectangular). (NOTE: Drawings to be prepared for given structural details. Also, Bar Bending Schedule should be prepared for above drawings) **7 Hrs**
4	Column footing- Column and footing (Square and Rectangle). Staircase–Dog legged and open well staircase (NOTE: Drawings to be prepared for given structural details. Also Bar Bending Schedule should be prepared for above drawings) **7 Hrs**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1		**Hours**
1.	Students are informed to visit field and analyse the load transfer pattern on existing structures	
Total		**14**
ABL2 (13 Hours): Activity 2		**Hours**
1.	Students are informed to analyse the existing structures by models of column buckling analysis	
Total		**13**

Evaluation of Learning Process(7 Hours)

Type of Evaluation	Hours
Test(1,2 and 3)	3
Quiz(1and 2)(optional)	1
Lab Test	3
Semester End Exam	3
Total	**10**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1		**3**	**2**										
CO2		**3**				**2**							
CO3	**3**		**2**			**2**							
CO4		**3**											

Course Title	IRRIGATION ENGINEERING AND HYDRAULIC STRUCTURES		
Course Code	24CV602	(L-T-P)C	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	100 marks	Total Hours	42L+48ABL=90

Course Objective: To provide comprehensive understanding of Design of Hydraulic structures forms an integral part of water resources engineering projects.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Evaluate the principles of irrigation, including its necessity, sources of water (surface and groundwater), irrigation systems	PO1, PO2	PSO1
2	Apply the principles to estimate irrigation requirements and quantity of discharge through Lacey's & Kennedy's method	PO1, PO2, PO3	PSO1
3	Explain and analyze reservoir planning and gravity dam design, including site investigation, storage estimation, forces acting on dams	PO1,PO2, PO3	PSO1
4	Explain and apply the principles of earth dams and hydraulic structures, and energy dissipaters including IS stilling basins	PO1, PO3	PSO2

MODULE-1 — 10 Hrs.

Introduction to Irrigation: Definition, necessity of irrigation, Sources of water: surface and groundwater, System of irrigation: flow irrigation, lift irrigation, Bandhara irrigation.

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

Self-study component : The Students shall visit an irrigated field at a nearby place and collect the information and take snapshots of types of crop grown, types / method of irrigation adopted, Techniques of irrigation used.

MODULE-2 — 10 Hrs.

Irrigation Structures: Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals.

Standard sections. Design of canals by Lacey's and Kennedy's method (Simple Numerical Problems).

Self-study component : The Students shall visit a nearby ongoing or completed minor irrigation project and collect the information about the potential of existing and ongoing projects. The department of minor irrigation shall be visited, and information collected.

MODULE-3	10 Hrs.

Reservoirs: Definitions, Investigation for reservoir sites. Capacity contours, Estimation of storage volume, Volume elevation and Area elevation curve. Storage zones. Determination of storage capacity and yield of a reservoir using mass curve.

Gravity Dams: Introduction, forces acting on dam, cause of failure, Elementary and practical profile of a gravity dam, Low and high gravity dams, Drainage galleries

Self-study component: The students shall visit the following sites and collect the information on the irrigation potential and other aspects of the projects: (1) Gorur Dam (Hemavathy River Irrigation Project), and (2) Yagachi dam (Yagachi River Irrigation Project)

MODULE-4	10 Hrs.

Earth Dams: Introduction, types, factors governing selection of dam, causes of failure of earth dams, Design criteria- Check Dam, Determination of phreatic line.

Spillways: Introduction, Types, Diversion Headworks, Types, Bligh's and Koshla's theory, Simple Problems on floor design. Energy dissipaters: Types and Introduction to IS Stilling basins

Self-study component: The students shall visit any irrigation project having an earthen dam and spillways and submit a report.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Irrigation Engineering and Hydraulic Structures	S. K. Garg,	38th Revised	Khanna Publishers	2023
2	Irrigation and Water Power Engineering	Punmia and Pandey Lal	17th	Lakshmi Publications	2021

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Text Book of Irrigation Engineering and Hydraulic Structures	R. K. Sharma,	1st	Oxford and IBH,	2016
2	Irrigation, Water Resources and Water Power	P. N. Modi,	9th	Standard Book House	2014

EBooks and online course materials:

1. https://archive.nptel.ac.in/courses/126/105/126105010/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Examine the various components of hydraulic structures through field visit and communicate and report the need and importance of them	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Visit an agricultural field and prepare a report on the irrigation method being adopted for water supply	07
2	Identify the different crops cultivated across various seasons and estimate the duty and delta for each crop	07
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Visit a hydraulic structure (dam or barrage) and identify its various components, explaining the function of each.	08
2	Analyse the various possible failure issues (cracks, seepage, erosion) and compare with theoretical concepts (Modules)	05
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**3**	**2**										**3**	
CO2	**3**	**2**	**2**									**3**	
CO3	**3**	**3**	**2**									**3**	
CO4	**3**	**2**										**3**	

Course Title	APPLIED GEOTECHNICAL ENGINEERING		
Course Code	24CV603	**(L-T-P)C**	(3-0-0) 3
Exam	3 Hrs.	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: Apply soil mechanics principles to design and analyze foundations, evaluate soil stability, and solve geotechnical engineering problems.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Analyze retaining wall by computing the lateral earth pressure for active and passive cases and stability of earth slope in the construction of canals, road embankments and earthen dams.	PO1, PO2, PO4	
2	Evaluate the vertical stress under the loaded area using the concept of stress distribution in soil	PO2, PO4	
3	Analyze the bearing capacity of different variety of soils subjected to different types of loading conditions and field methods for suitability of different types of foundations and ground conditions	PO1, PO2, PO4	
4	Apply the concept of ground improvement techniques for different types of foundation soils	PO1, PO2, PO4	

MODULE-1	**10 Hrs.**

Earth Pressure: Active & Passive earth pressure, earth pressure at rest, earth pressure coefficient and their range. Rankine's theory of earth pressure – Assumptions and limitations. Lateral earth pressure in cohesive and cohesionless soil.

Stability of Earth Slopes: Types of slopes, Causes and types of failure of slopes. Definition of factor of safety. Stability of finite and infinite slopes - Method of slices, Friction circle method, Fellineous method. Taylor's stability number.

Self-study component: Students shall visit the site and study the overview of the site conditions and know the different parts of the structures like retaining walls, highway or railway embankments and earthen dams etc.

MODULE-2	**10 Hrs.**

Stresses in Soil: Boussinesq's and Westergaard's theories for concentrated, circular load, rectangular loads, and strip load. Pressure bulb (Isobar) concept. Newmark's chart.

Bearing Capacity: Definitions of ultimate, net and safe bearing capacities. Allowable bearing pressure. Rankine's, and Terzaghi's analysis, Assumptions and limitations of Terzaghi's bearing capacity. Types of failures. Brinch Hansen's bearing capacity equation. Effect of groundwater table on bearing capacity of soil.

Self study component: Students shall visit the site and study the ground conditions and types of soils. They shall obtain the soil samples from the field and conduct the laboratory tests and calculate the safe bearing capacity of soil and submit the report.

MODULE-3	**10 Hrs.**

Bearing Capacity from Field Tests: Plate-load test: Procedure, limitations of plate load tests use of N values for calculating bearing capacity and allowable soil pressure, Static and Dynamic cone penetration test.

Shallow Foundations: Definition of foundation, General types of foundation, types of shallow foundation, settlement of foundation – concept and types - immediate, consolidation and secondary settlements (No derivations).

Self-study component: Students shall visit the site and study the ground conditions and assess the suitability of different types of foundations for different types of soil conditions.

MODULE-4	**10 Hrs.**

Pile Foundations: Necessity of pile foundations, classification of pile foundations, different types of piles and their advantages and limitations. Simple methods of estimating bearing capacity of piles – Dynamic formulae, static formulae, and pile load test. Negative skin friction.

Introduction to Ground Improvement Techniques - Importance, methods - vibrofloatation, stone column, blasting, compaction piles, cement grout, thermal treatment and electro-osmosis.

Self-study component: Students shall visit the site and study the site conditions and collect the geological information. Also, they shall apply the knowledge to adopting different techniques for different types of soil for ground improvement technique.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Geotechnical Engineering	Venkataramaiah C	Revised third Ed	New Age International publishers,	2006
2	Soil Mechanics and Foundations	Punmia, B.C. Ashok Kumar Jain &Arun Kumar Jain		Laxmi Publishing Co	2003

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Foundation Analysis and Designs	Bowles,I.E	5thEd	Mc Graw Hill Publishing	1996
2	Principles of Soil Mechanics and Foundation Engineering	Murthy, V.N.S	5th Revised Ed	UBS Publishers and Distributors ltd	2001

EBooks and online course materials:

https://archive.nptel.ac.in/courses/105/105/105105185/
https://onlinecourses.nptel.ac.in/noc22_ce96/preview

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted 1. Students undertake field visits to complete assignments, enabling them to understand soil bearing capacity and the stability of geotechnical structures. 2. Short quizzes are conducted regularly for each module to understanding of recently covered concepts.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Students undertake field visits to complete assignments, enabling them to understand soil bearing capacity and the stability of geotechnical structures.	**14**
Total		
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Short quizzes are conducted regularly for each module to understand recently covered concepts.	**13**
Total		**27**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3			2									
CO2		3		2									
CO3	3	2		2									
CO4	3	2		1									

Course Title	MAIN PROJECT PHASE - I		
Course Code	24PROJ1	**(L-T-P)C**	(0-0-4)2
Exam	3 Hrs.	**Hours/Week**	4
SEE	100 Marks	**Total Hours**	50

Course Objective: To involve in team work to demonstrate the acquired skill & knowledge aimed to identify, formulate, analyze, evaluate and to provide meaningful engineering solutions to industrial/ societal needs.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Identify a problem from the available literature and societal needs	PO2, PO4	
2	Apply principles of Civil Engineering in designing and conducting experiments, data acquisition and interpretation towards meaningful analysis of identified problem	PO2, PO4, PO5,	PSO1
3	Use analytical, teamwork and leadership skills in designing and development of products and find sustainable solution to the identified problem	PO4, PO5, PO6, PO7, PO8, PO9,	PSO2
4	Prepare a detailed project report and present the work using appropriate presentation tools	PO9,PO10,PO11,	PSO2

PHASE – Scope	**40 Hrs.**

1. Student project batches will be formed at the commencement of the sixth semester.
2. Project batch students will be informed to meet their guides and obtain approval from them.
3. Project students will carry out necessary literature reviews and set objectives in consultation with their respective guides. Students are also encouraged to implement Artificial Neural Networks (ANN) and Artificial Intelligence (AI) in the project objective.
4. Students will present their work before a committee, and necessary corrections will be provided.
5. The progress of Phase 1 will be monitored regularly.
6. The introduction, literature review, gap identification, objectives, methodology, and materials required will be finalized during Phase 1.
7. At the end of the semester final evaluation will be done, students should submit the project phase one report and to highlight the progress of the project till date.
8. Also project batches should mention the pending work for the upcoming semester.
9. Students are encouraged to participate in the National/International Conference and represent their work.
10. Also, students are encouraged to publish their work in a reputed journal (SCOPUS/WOS).

The evaluation follows the below-mentioned scheme:

Sl. No.	Criteria	CIE
1	Organization	20
2	Content	20
3	Subject knowledge	20
4	Presentation	20
5	Communication and Time Management	20
	TOTAL	**100**

Final project report should have the following contents:

1. Introduction – Showing the relevance of the subject in the present context /motivation
2. Literature Review
3. Objectives and scope of the Project
4. Materials and Methodology

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1		**3**		**3**									
CO2		**3**		**3**	**3**							**3**	
CO3				**3**	**3**	**3**	**3**	**3**	**3**				**3**
CO4									**3**	**3**			**3**

Course Title	Structural Dynamics		
Course Code	24CV651	**(L-T-P)C**	(3-0-0)3
Exam	3 Hrs	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: To analyze SDOF and MDOF for undamped and damped structures for free and forced vibration.

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

#	Course outcomes	Mapping to Pos	Mapping to PSO's
1	Comprehend principles of vibration and elementary components of a vibratory system, analyze undamped and damped free vibration of a single degree of freedom system	PO1, PO2, PO3	
2	Analyze undamped and damped forced vibration of a single degree of freedom system	PO2, PO3, PO4	
3	Comprehend the response of SDOF to general system of loading	PO2, PO3, PO4	
4	Analyze MDOF systems	PO2, PO3, PO4	

MODULE-1	11 Hrs.

Introduction; Laws of motion, D' Alembert's Principle, Stiffness of springs in series and parallel, Mas inertia, Simple harmonic motion, Definition of vibration – Parts of a vibrating system –Degrees of free of vibration. Free vibration; Undamped and damped free vibration of a single degree of freedom system- decrement.

Self-study component: Students shall collect material from the internet on fundamentals of dynam vibration, prepare a report and submit

MODULE-2	11 Hrs..

Forced Vibration; Undamped and damped forced vibration of a single degree of freedom system – Steady state response, Dynamic magnification factor, response to harmonic loading. Forced vibration (cont'd); Rotational and reciprocating unbalance, Force transmissibility, Force transferred to the foundation.

Self-study component: Students shall collect material from the internet on forced vibration and its effect on machine foundation. Prepare a report and submit.

MODULE-3	10 Hrs..

SDOF subjected to base excitation; Harmonic base excitation, Vibration isolation, Vibration measuring instruments. Response of SDOF for general System of loading (undamped); Duhamel' Integral – dynamic load factor for step, rectangular, ramp and triangular input

Self-study component: Students shall collect material from the internet on fundamentals of vibration isolation, vibration measuring instruments and response of a SDOF system. prepare a report and submit

MODULE-4	**10 Hrs.**

MDOF Systems: Free vibration – natural frequencies – Orthogonality principle. Eigen values and Eigen vectors, Shear buildings modeled as MDOF systems. MDOF Systems (Cont'd); Forced undamped and damped vibration of shear buildings – Modal superposition method – Response to harmonic excitation only.

Self-study component: Students shall observe the demonstration of vibration of MDOF system and collect material from the internet on fundamentals of MDOF systems subjected to both forced undamped and damped vibrations. prepare a report and submit

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Vibrations, Dynamics and Structural Systems	Mukhopadhya, M	Ane's Student	Oxford IBH Publications	2000
2	Structural Dynamics	Mario Paz	5th	CBS Publishers	2004

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Dynamics of Structures	Clough & Penzien	2nd	McGraw Hill Publisher	2015
2	Dynamics of structures: Theory and applications to earthquake engineering.	Chopra, A. K.	5th	Prentice Hall, NJ, USA	2020

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/105/106/105106151/
2. https://archive.nptel.ac.in/courses/105/101/105101006/
3. https://onlinecourses.nptel.ac.in/noc24_ce74/preview
4. https://archive.nptel.ac.in/courses/105/104/105104189/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted 1)Assignment 2) Group Activity	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Students will visit the Earthquake Laboratory to understand the working principles of manual shake tables and observe SDOF frame models used for studying free vibration, forced vibration, resonance, damping, and modal behavior of structures. This activity enhances understanding of structural dynamics concepts and practical vibration behavior of structures.	
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1.	Students will visit nearby bridge or flyover construction sites to observe the use of structural dampers and vibration control systems adopted in large civil engineering structures. Based on this students will prepare a report.	
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**1**	**3**	**2**										
CO2		**3**	**2**	**1**									
CO3		**3**	**2**	**1**	**1**								
CO4		**3**	**2**	**1**	**1**								

Course Title	**Pavement Analysis & Design**		
Course Code	24CV652	(L-T-P)C	(3-0-0)3
Exam	3 Hrs	Hours/Week	3
SEE	100 Marks	Total Hours	42L+48ABL=90

Course Objective: To develop the ability to understand pavement engineering concepts and apply IRC-based methodologies for the analysis, design, and maintenance of highway pavements.
Course Outcomes: At the end of course, students will be able to analyze pavement stresses, design flexible and rigid pavements, evaluate pavement performance, and recommend sustainable pavement solutions for transportation infrastructure.

#	**Course outcomes**	**Mapping to Pos**	**Mapping to PSO's**
1	Analyze pavement structure, distress development, and traffic load effects to evaluate pavement performance and maintenance requirements. .	PO1, PO2	
2	Analyze and design flexible pavements using IRC standards and mechanistic design concepts.	PO2, PO3	
3	Analyze stresses in rigid pavements and design of rigid pavement systems and joints as per IRC recommendations.	PO2, PO3	
4	Apply geosynthetics and sustainable pavement technologies to enhance pavement performance and service life.	PO2, PO3, PO7	

MODULE-1	**12 Hrs.**

Introduction: Importance, Functions, Requirements, Factors affecting Design and Performance of Pavements – Functions and Significance of various layers – Factors affecting the choice and selection of pavement type. Distress: Distresses in Asphalt and Concrete pavements, Major distress mechanisms. Traffic: Different types of highway traffic, Measurement of traffic load, Load distribution concept, Load equivalency factors – ESAL and ESWL of Multiple Wheels.

Self-study component: Students shall visit a nearby highway, urban road or industrial road and identify different pavement distresses

MODULE-2	**10 Hrs..**

Design of Flexible Pavements: Stresses, Strains and Deflections in Homogeneous Masses – Layered systems concept, Elastic Solutions, Visco-elastic Solutions. Mechanistic-Empirical design Principles, Design steps – IRC method of Flexible Pavement Design for High Volume Roads (IRC 37) and for Low Volume Roads (IRC SP 20).

Self-study component: Students shall select an existing highway project (NH, SH, Expressway, or Industrial Road) and study the flexible pavement composition adopted.

MODULE-3	**10 Hrs..**

Design of Rigid Pavements: General conditions in Rigid Pavement Analysis, Types of Stresses and Causes – Wheel Load Stresses, Warping Stresses, Frictional Stresses, Combined Stresses. Design steps – IRC method of Rigid Pavement Design for High Volume Roads (IRC 58) and for Low Volume Roads (IRC SP 62). Joints in Pavements and their Functions, Design of Joint Details, Concrete White topping.

Self-study component: Investigate a rigid pavement such as a concrete road, industrial yard, toll plaza, bus terminal and their distress pattern.

MODULE-4	**10 Hrs.**

Sustainable Pavements: Geosynthetics – Types, Properties and Functions, Applicability and Benefits of Geosynthetics in Roadways, Unbound Pavement Layers and Subgrade stabilization (IRC 59); Concept of Life Cycle Cost – Approaches & Techniques, Cost-Saving Concepts – Perpetual Pavements, Recycling techniques; green highways.

Self-study component: Analyze a real-world project involving geosynthetics, recycled pavement materials, white-topping, or green highway initiatives.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	"Principles of Pavement Design"- Wiley India Pvt Ltd., 2nd Edition, 2011	Yoder E J and Witczak M W	2	Wiley Publishers	2011
2	"Pavement Analysis and Design", Pearson Education, 2nd Edition, 2008.	Huang	2	Pearson Publishers	2008

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	"Highway Engineering", Nem Chand and Bros. Roorkee, 10th Edition, 2014	S.K. Khanna, C.E.G. Justo and A. Veeraragavan	10	Nem Chand and Bros. Roorkee	2014
2	"Modern Pavement Management", McGraw Hill and Co., 1st Edition, 1994.	W. Ronald Hudson, Ralph Haas and Zeniswki	6	University Press	2019

EBooks and online course materials:

https://https://onlinecourses.nptel.ac.in/noc24_ce80/preview

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted Details of activity 1 - Students shall carry out the activity as mentioned in the self study component and submit a report. Details of activity 2 - Analyse the stress & strain developed in flexible pavements using IIT pave software.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Visit a nearby road and identify different pavement distresses such as cracks, potholes, rutting, and patch repairs.	9
2	Take photographs and discuss the possible reasons for the failures and prepare the report	5
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Observe a bituminous road and a concrete road in your locality. Compare them based on construction, surface condition, maintenance requirements, cost, and performance.	7
2	Prepare a short report with photographs.	6
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
Test	3
Viva voce	1
Semester End Exam	3
Total	7

Course Articulation Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2	-										
CO2	3	3	3	2									
CO3	3	3	3	2									
CO4	3	2	3	2			3						

Course Title	RURAL WATER SUPPLY & SANITATION		
Course Code	**24CV653**	**(L-T-P)C**	(3-0-0)3
Exam	3 hrs	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: To provide knowledge on technical aspects of drinking water supply and scope of sanitation in rural areas

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

#	Course Outcomes	Mapping to POs	Mapping to PSO's
1	Discuss the importance of village community and need for protected water supply	PO1, PO6	-
2	Describe the need and methods of water treatment and rural sanitation	PO1, PO6	-
3	Assess different methods of rainwater harvesting and refuse disposal	PO1, PO6	-
4	Discuss various methods of controlling communicable diseases and milk sanitation	PO1, PO6	-

MODULE-1	**11 Hrs.**

Introduction: Importance of Village community in India, Need for protected water supply, Traditional sources of water in rural areas, Investigation and selection of water sources

Rural Water Supply: Waterborne diseases, protection of well waters, drinking water quality standards, Water lifting arrangements, Water supply system

Self Study Component: Explore methods of investigating and selecting water sources, including: Site selection, Water table considerations and Quality and quantity assessment.

MODULE-2	**11Hrs.**

Water Treatment Methods: Disinfection, Defluoridation, Hardness and iron removal, water quality surveillance, groundwater contamination and control

Improved methods and compact systems of treatment: Brief Details of multi-bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion cartridges. Water supply during fair, festival and emergencies.

Rain Water Harvesting: need, advantages, components of roof top rain water harvesting system, methods of rainwater harvesting, maintenance tip for rainwater harvesting structure

Self Study Component: Visit a local or online water treatment project and summarize the treatment method used.

MODULE-3	**10 Hrs.**

Rural Sanitation: Disposal of night soil, requirement of privy, types of privies, disposal by trenching and composting, Imhoff tank, septic tank, soak pit, Sullage and storm water disposal

Refuse Collection & Disposal: Types and characteristics of refuse, refuse collection – planning and collection system. Refuse disposal – dumping, hog feeding, methods of composting, methods of sanitary land filling. Dung disposal and biogas plant for dung disposal

Self Study Component: Study a case example of rural sanitation success (e.g., Swachh Bharat Abhiyan village case study)

MODULE-4	**10 Hrs.**

Communicable Diseases and Insect Control: Terminology, classification, modes of communication, general methods of control. House fly and mosquito - life cycle, disease transmission and control measures

Milk Sanitation: Essential of milk sanitation, Essential tests for milk quality, methods of pasteurization, cattle borne disease and planning for a cow shed.

Self-study: Students shall visit nearby villages and study different sanitation methods adopted and shall submit a report of their observations under self-study components.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Rural Water Supply and Sanitation	Peter Harvey, Bob Reed	1st Edition	ITDG Publishing / Practical Action Publishing	2004
2	Rural Water Supply and Sanitation	Peter G. Bourne	1st Edition	Academic Press	1977

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Potable Water Treatment Processes	Simon Parsons	1st Edition	Blackwell Publishing	2004
2	Appropriate Technologies for Rural Water Supply and Sanitation	R. Franceys, J. Pickford	1st Edition	WEDC, Loughborough University	1995

EBooks and online course materials:

https://www.eolss.net/ebooklib/sc_cart.aspx?File=E2-14-03-03

Online Courses and Video Lectures:

1. **Urban Utilities Planning: Water Supply, Sanitation and Drainage By Prof. Debapratim Pandit,IIT Kharagpur**

https://onlinecourses.nptel.ac.in/noc24_ar18/preview

2. **Wastewater Treatment and Recycling by Prof. Manoj Kumar Tiwari, IIT Kharagpur**

https://onlinecourses.nptel.ac.in/noc24_ce105/preview

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted 1. Group Activity 2. Presentation	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Field visit	7
2	Hand written detailed field Report	7
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Content of Presentation	7
2	Presentation Skill	6
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**3**					**2**							
CO2	**3**					**2**							
CO3	**3**					**2**							
CO4	**3**					**2**							

Course Title	GROUNDWATER HYDRAULICS		
Course Code	24CV654	**(L-T-P)C**	(3-0-0)3
Exam	03 Hrs.	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+48ABL=90

Course Objective: Understand the basics of groundwater including its properties, flow principles according to Darcy's Law, and aquifer characteristics such as types and parameters. Apply knowledge to analyze groundwater systems, including well hydraulics, contaminant transport, and management strategies for sustainability and remediation.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Comprehend the importance of groundwater resource management to develop and implement effective utilization, planning, and conservation strategies.	PO1	
2	Apply the aquifer and flow characteristics to assess groundwater availability, movement and exploration.	PO1	
3	Analyze aquifer recharge processes and groundwater utilization to develop knowledge of resource management.	PO2	
4	Report on Ground water availability and Depletion in Hassan District, to analyze its impact on Environmental Sustainability through Recognizing the need for possible Recharge Techniques	PO6, PO9, PO11	

MODULE-1	**10 Hrs.**

Introduction: Importance, Occurrence and Distribution of sub-surface water, Aquifer and its types, Aquifuge, Aquitard and Aquiclude.

Aquifer Properties: Specific yield (Laboratory and Field Methods), Specific retention, Porosity, Storage coefficient, Land Subsidence due to ground water withdrawals.

Self-Study Component: Students shall collect the ground water depletion information from the department of geology. Information from the observation well and their data of ground water level.

MODULE-2	**11 Hrs.**

Darcy's Law and Hydraulic Conductivity: Darcy's law, Hydraulic conductivity & Intrinsic permeability, Transmissibility, Permeability in Isotropic and Anisotropic layered soils.
Well Hydraulics – Steady Flow: Steady one-dimensional flow, Steady radial flow in confined and unconfined aquifers, Pumping tests.

Self-study component: Collect the information on the existing number of bore wells in Hassan districts & their classification on the basis of ownership (government /private) and permission from the authority (with permission/without permission).

MODULE-3	**10 Hrs.**

Well Hydraulics – Unsteady Flow: Theis method, Cooper- Jacob method, Chow's method. Simple numerical problems.
Ground Water Development: Types of wells- Tube well design, Dug Wells, Method of constructions-working principles, Power & stages requirements, Sea water intrusion.

Self-study component: Students shall collect the information on types of ground water recharge structures. Information on existing recharges structure in Hassan District.

MODULE-4	**11 Hrs.**

Ground water Explorations: Seismic method, Electrical resistivity method, Borehole geophysical techniques- Electrical logging, Radio wave logging, Induction logging, Sonic logging and Fluid logging.
Ground water recharge and Runoff: Recharge by vertical leakage, Artificial recharge, Ground water runoff, Ground water budget.

Self-study component: Review on Watershed development, different policies, and schemes by government (public and private). Best examples at district level, State level and national level.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Ground Water	Raghunath H.M	4th Edition	New Age International Publishers	2008
2	Groundwater Hydrology	David K.Todd. Larry W.Mays	3rd Edition	Wiley India Pvt. Ltd, New Delhi.	2005

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Hydrology	Jaya Rami Reddy P	3rd Edition,	Laxmi Publications Pvt. Ltd. New Delhi.	2016
2	Numerical Groundwater Hydrology	Rastogi A. K	Revised	Penram International Publishing. (Ind) Pvt Ltd, Mumbai	2008

EBooks and online course materials:

1. https://link.springer.com/book/10.1007/978-4-431-53959-9

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/105/105/105105042/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted 1. Report on Ground water availability and Depletion in Hassan District, to analyze its impact on Environmental Sustainability through Recognizing the need for possible Recharge Techniques	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Report on Ground water availability and Depletion in Hassan District.	5
2	Analyze its impact on Environmental Sustainability	4
3	Recognizing the need for possible Recharge Techniques	5
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Analyze groundwater flow characteristics using analytical and numerical method.	6
2	Evaluate the impact of hydraulic properties on groundwater movement.	7
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2											3	
CO2	3											3	
CO3		3										3	
CO4						2			2		2		3

Course Title	MODERN CONSTRUCTION METHODS AND MECHANIZATION		
Course Code	24CV655	**(L-T-P)C**	(3-0-0) 3
Exam	3 Hrs.	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective:

1. To introduce the learner to the various types of equipment that are used in construction projects.
2. To impart knowledge about the application of these equipment for performing various construction activities in projects.

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

CO's	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply various advanced construction techniques in sub structure and super structure of the building.	PO5,PO6	
2	Apply techniques and implementation of the paving technology in construction.	PO5	
3	Analyze contemporary issues pertaining to construction methods, equipment usage and management.	PO2	
4	Investigate and identify advanced construction methods and materials by visiting an active construction site.	PO6, PO9	

MODULE-1	10 Hrs.

Sub Structure Construction: Box jacking, pipe jacking – under pinning, trenchless technology, innovative road construction techniques; immerse tube tunnelling. Smart tunnels: application and construction

Self-study component: The students shall visit construction site to visualize box pushing and trenchless construction techniques and submit a report

MODULE-2	11 Hrs.

Super Structure Construction for Building: Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching erection techniques of tall structures, large span structures – launching techniques for heavy decks –in situ prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures 3D Printing techniques in Construction industry.

Self-study component: The students shall visit paving industries to understand the working of various machineries and submit a report .

MODULE-3	10 Hrs..
Construction of Special Structures: Erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges Advanced construction techniques for offshore structures – construction sequence and methods in domes & prestress domes – support structure for heavy equipment & conveyor & machinery in heavy industries – erection of articulated structures, braced domes & space decks ***Self-study component : Students shall collect the information on advanced construction techniques in India***	
MODULE-4	**11 Hrs.**
Form Works for Different Construction Techniques Introduction: Formwork and false work, Temporary work systems, Construction planning and site constraints, Materials and construction of the common formwork and false work systems, Special and proprietary forms., Types of beams, decking and column formwork, Design of decking, Falsework design, Effects of wind load, Foundation and soil on falsework design. Special Forms: The use and applications of special forms. Construction Sequence and Safety in use of Formwork: Sequence of construction, Safety use of formwork and falsework ***Self-study component : Students shall collect the information on types of formwork used in India***	

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Modern Methods of Construction and Innovative Materials	Arthur Lyons	(2nd ed.).	Routledge	2024
2	. "Construction Planning, Equipment, and Methods"	Peurifoy, R., Schexnayder, C., Shapira, A., & Schmitt, R.	(8th ed.).	McGraw-Hill.	(2011)

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	"Construction methods and management" .	Nunnally, S. W.	(8th ed.)	Prentice Hall.	(2011)
2	"Construction equipment management for engineers, estimators, and owners"	Gransberg, D. D., Popescu, C. M., & Ryan, R. C	(2nd ed.)	CRC Press.	(2006)

EBooks and online course materials:

1. https://www.nhbc.co.uk/binaries/content/assets/nhbc/foundation/a-guide-to-modern-methods-of-construction.pdf
2. **https://www.buildoffsite.com/content/uploads/2019/04/modern-methods-of-construction-paper-rics.pdf**

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc21_ce21/preview
2. **https://onlinecourses.swayam2.ac.in/nou25_ce05/preview**

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted activity 1: Examine the various modern techniques in construction sites through field visit and communicate and report activity 2 : Regular short quizzes conducted for each module for understanding of the most recent concepts.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Provide equipment cards (microtunneling, HDD, pipe bursting) and scenario cards (urban water main, railway crossing, contaminated soil). Students match methods to scenarios, justifying based on ground conditions, diameter, length limits.	7 hrs
2	Collecting and discussing the various Construction equipments details through certificate and Brochures	7 hrs
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Visiting the various Construction sites of industrial floors applications	7 hrs
2	Visiting Railway underpass which made us of BOX Pushing Technology identifying, its various Components and prepare a report	6 hrs
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1					2	3							
CO2					2								
CO3		3											
CO4						3			3				

Course Title	COMPOSITES & SMART MATERIALS		
Course Code	24CV656	(L-T-P)C	(3 - 0 - 3) 3
Exam	03 Hours	Hours/Week	03
SEE	50 Marks	Total Hours	42L+48ABL=90

Course Objective: To enable students to understand the behavior, analysis, and applications of composite and smart materials.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Comprehend the basic properties and mechanical behavior of composite materials in different directions	PO1	
2	Apply laminate theory and micromechanical models to study single and multi-layer composite materials behavior and its failures	PO1	
3	Analyze the role of smart materials like sensors and actuators in enhancing structural performance	PO2	
4	Analyze smart, sustainable materials to address industry-specific problems, and work in teams to evaluate their performance and communicate their practical benefits	PO6, PO8 PO9	

MODULE-1	10 Hrs.

Introduction to Composites materials: Classifications and applications of fibers, matrix and Composite materials, Weight and Volume fraction and load distribution among constituents, minimum & critical volume fraction, Compliance & Stiffness matrices.

Self-Study component: Students shall gain knowledge about the innovative composite materials and their applications in the Civil engineering domain.

MODULE-2	11Hrs.

Anisotropic elasticity - Unidirectional and anisotropic lamina, thermo- mechanical properties, micromechanical analysis, classical composite lamination theory. Cross and angle–ply laminates, symmetric, antisymmetric and general asymmetric laminates, mechanical coupling and laminate stacking.

Self-Study component: Students shall explore appropriate websites to observe the behavior of composite material subject to varying temperature.

MODULE-3	11 Hrs..

Analysis of simple laminated structural elements - Ply-stress and strain, lamina failure theories - first fly failure, environmental effects and manufacturing of composites-Hand layup technique, Pressure bag and Vacuum bag technique, Resin transfer moulding, Injection Moulding and Pultrusion.

Self-Study component: Students shall learn different types of composite materials and their application in aircraft design.

MODULE-4	10 Hrs.

Smart materials - Introduction, Types of smart structures, actuators & sensors, embedded & surface mounted actuators and sensors, piezoelectric coefficients, phase transition, piezoelectric constitutive relation. ***Self-Study component: Students shall learn about self-healing materials used in the aircraft industry etc..***

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Analysis and Performance of Fiber Composites	Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara	4th	John Willy and Sons	2017
2	Mechanic of Composite Materials	Robart M Jones	2nd	McGraw Hill Publishing Co.	1999

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	An Introduction to Composite Principles of Composite Material Mechanics Materials	Clyne, T. W., & Hull, D.	2nd	Cambridge University Press	2019
2	Principles of Composite Material Mechanics	Gibson, R. F.	4th	CRC Press	2016
3	Analysis and Performance of Fiber Composites	Agarwal, B. D., Broutman, L. J., & Chandrashekhara, K.	3rd	Wiley India	2006

EBooks and online course materials:

1. https://www.academia.edu/93600895/Smart_Structures_Theory
2. https://dokumen.pub/composite-materials-science-and-engineering-4th-ed-2019-978-3-030-28982-9-978-3-030-28983-6.html?utm_source=chatgpt.com

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/105/108/105108124/
2. https://nptel.ac.in/courses/112104173

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted Work in a team to choose a smart material and explain how it can be used to solve a problem in a specific industry (like automobiles, space, medical, or construction). Describe how it works, why it's better than regular materials, and what benefits it offers.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Work in a team to choose a smart material and explain how it can be used to solve a problem in a specific industry	10
2	Prepare report	4
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Describe how it works, why it's better than regular materials, and what benefits it offers.	10
	Prepare report	3
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2												
CO2	3												
CO3		3											
CO4						2		2	2				

Course Title	SOLID WASTE MANAGEMENT		
Course Code	24CV657	**(L-T-P)C**	(3-0-0) 3
Exam	03 Hrs.	**Hours/Week**	03
SEE	100 marks	**Total Hours**	42L+48ABL= 90

Course Objective: To learn broader understandings on various aspects of solid waste management practice

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

#	Course outcomes	Mapping to POs	Mapping to PSOs
1	Comprehend the sources, classification, characteristics and system of collection of solid waste	PO1, PO2, PO6,	—
2	Learn different methods of transportation and treatment of solid waste	PO1, PO2, PO6	—
3	Comprehend the various methods of air pollution control techniques and types of composting	PO1, PO6,	—
4	Learn different disposal methods of solid waste and hazardous waste	PO1, PO6,	—

MODULE-1	11 Hrs.

Introduction: Land Pollution – Definition, causes, health and environmental effects of waste. Scope and importance of solid waste management – Classification, source and characteristics. Estimation of energy content. Material flow and Functional elements of solid waste management.

Collection: segregation at source, Types of collection service. Systems of collection – hauled container and stationary container system. Estimation of solid waste quantities. Collection equipment – Garbage chutes. Bailing and compacting

Self Study Component: Study waste management practices of any Indian city (e.g., segregation, collection efficiency). Compare with SWM Rules 2016.

MODULE-2	11 Hrs.

Transportation and Processing Techniques: Transport methods, Transfer station and route optimization techniques. Mechanical volume reduction, Chemical volume reduction, Mechanical size reduction, Component separation, Drying and dewatering. **Waste Disposal**: key issues in waste disposal, disposal options and selection criteria. **Incineration** - Process, Design and Performance Considerations, 3T's of incineration process and problems associated with incineration operation

Self Study Component: Use Google Maps or simple mapping to design an optimized waste collection route for a small area. Evaluate time and fuel savings.

MODULE-3	10 Hrs.
Incineration Emission Control Technologies: Gravitational settling chambers, Cyclone separator, Fabric filters, Electrostatic precipitators and Scrubbers **Composting**: Objectives, Aerobic and anaerobic composting – process and design consideration. Bangalore process of composting and Indore process of composting. Factors affecting composting. Vermicomposting ***Self Study Component: Prepare compost using kitchen waste (aerobic or vermicomposting). Record observations (temperature, odor, decomposition time).***	
MODULE-4	**10 Hrs.**
Sanitary Land Filling: Different types – Trench, area and Ramp Method. advantages and disadvantages, Site selection. environmental effects of landfill, landfill operation issues. landfill gas emission and leachate formation. **Hazardous waste management**: classification of hazardous waste, exposure pathway and effects **Biomedical waste**: classification, potential implication and steps in biomedical waste management ***Self-Study: Visit a clinic/lab (or study online protocols). Identify waste categories and check compliance with handling procedures.***	

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Integrated Solid Waste Management	George Tchobanoglous	II	McGraw-Hill	1993
2	Solid Waste Management	K. Sasikumar and Sanoop Gopi Krishna	III	PHI Learning Pvt. Ltd.	2009
3	Hazardous Waste Management	LaGrega, Buckingham & Evans	II	Barnes & Noble	2010

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Handbook of Solid Waste Disposal: Materials and Energy Recovery	Pavoni, Heer Jr., and Hagerty	I	Krieger	1975
2	Environmental Engineering	Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous	I	McGraw-Hill	2017

E Books and online course materials:

1. **Waste Management Practices: Municipal, Hazardous, and Industrial -**

   https://www.routledge.com/Waste-Management-Practices-Municipal-Hazardous-and-Industrial/Pichtel/p/book/9781466585188

2. **An Introduction to Waste Management and Circular Economy -**
   https://open.umn.edu/opentextbooks/textbooks/an-introduction-to-waste-management-and-circular-economy

Online Courses and Video Lectures:

1. **Municipal Solid Waste Management - https://onlinecourses.nptel.ac.in/noc24_ce77/preview**

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 3. Group Activity - Field visit and report submission 4. Quiz	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (25 Hours): Field Visit and Report Submission - Group Activity		Hours
1.	**Municipal Solid Waste Collection System Analysis:** Observe local waste collection (door-to-door / community bins). Identify whether it is a hauled or stationary system. Evaluate efficiency, frequency, and manpower. Submit Field report with photos	05
2	**Visit to Transfer Station:** Observe transportation methods and equipment used. Study route optimization practices. Identify operational issues. Submit Observation report with flow diagram	05
3	**Composting Site Visit:** Visit a composting unit. (aerobic/vermicomposting). Observe process stages and factors affecting composting. Compared with theoretical methods (Indore/Bangalore). Submit a report on Process explanation with comparison	05
4	**Recycling Unit Observation:** Visit a recycling facility (plastic, paper, metal). Understand segregation, processing, and reuse. Identify economic and environmental benefits. Submit the report with Process flow chart	05
5	**Biomedical Waste Management Study:** Visit a hospital/clinic. Observe waste segregation (color coding), storage, disposal. Check compliance with rules. Submit audit-style report	05
Total		**25**
ABL2 (02 Hours): Activity 2 Details		**Hours**
1	Assignment	01
2	Quiz	01
Total		**02**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Quiz (1and 2) (optional)	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2					3							
CO2	3					2							
CO3	2					3							
CO4	3					2							

Course Title	WATER SUPPLY AND SANITATION		
Course Code	24OECV661	(L-T-P) C	(3-0-0)3
Exam	3 Hours	Hours/Week	3 Hrs
SEE	100 Marks	Total Hours	42L+48ABL=90

Course Objective: Prepare students to contribute to planning, implementation, and maintenance of water and sanitation systems in real-world community settings

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Estimate average and peak water demand for a community.	PO1, PO2	-
2	Evaluate water quality and plan suitable treatment system	PO1, PO6	-
3	Discuss various treatment methods available for treating drinking water	PO1, PO6	-
4	Evaluate wastewater quality and design suitable conveyance systems for sewage and design a comprehensive wastewater treatment system	PO1, PO6	PSO1

MODULE-1	11 Hrs.

Introduction: Need for protected water supply, Factors affecting water supply scheme and benefits. **Demand Of Water**: Types of water demands - domestic demand, institutional and commercial, public uses, fire demand. Factors affecting per-capita demand, variations in demand of water, Peak factor, Design periods and factors governing the design period. Different methods of Population forecasting. **Sources**: Concept of hydrological cycle, Surface and subsurface sources - suitability with regard to quality and quantity. Factors governing the selection of a particular source of water.

Self Study Component: Forecast the future population and design water supply scheme for Hassan city

MODULE-2	11 Hrs.

Quality of Water: Concept of safe water: wholesomeness, palatability and potability. Physico Chemical characteristics (Drinking water standards: BIS & WHO standards). Numerical problems on pH and MPN
Collection and Conveyance of Water: Intake structures - different types of intakes; factors for the selection and location of intakes. **Pumps** - Necessity, types and factors for the selection of a pump
Water Treatment: Objectives and Treatment flowchart – significance of each unit. **Aeration** – Principle, aerators.
Self Study Component: Visit nearby intake structure and submit a detailed report on it

MODULE-3	10 Hrs.

Sedimentation: Theory, settling tanks and types. **Filtration:** Mechanism - theory of filtration, types of filters- slow sand, rapid sand and pressure filters **Disinfection**: Definition, Requirements, methods of disinfection. **Softening**: Definition, methods of removal of hardness by lime soda-process and zeolite process with merits and demerits **Water Conservation** – Rain Water Harvesting.

Self study Component: Students shall visit nearby water treatment plants and study various treatment techniques adopted and shall submit a report of their observations

MODULE-4	10 Hrs.

Wastewater: Wastewater disposal - Necessity for sanitation, types of sewerage systems and their suitability. Quantification of sewage and estimation of storm water flow. **Sewer**: Sewer pipe materials, Shapes of sewers, laying of sewers, jointing and testing of sewers, ventilation and cleaning of sewer. **Sewer Appurtenances:** Catch basins, Manholes, Flushing tanks, oil and grease traps, Drainage traps, Basic principles of house drainage, typical layout plan showing house drainage connections

Self Study Component: Students shall visit the nearby Industry and observe the methods adopted for sewage treatment and disposal. The students shall submit a report of their observations under self-study components.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Environmental Engineering: Volume I – Water Supply Engineering	Santosh Kumar Garg	28	Khanna Publisher	2022
2	Environmental Engineering – Vol. II: Sewage Disposal and Air Pollution Engineering	S.K. Garg	29th Edition	Khanna Publishers	2022

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Water and Wastewater Technology	Mark J. Hammer & Mark J. Hammer Jr.	VII	Pearson Education	2012
2	Wastewater Engineering: Treatment and Resource Recovery	Metcalf & Eddy, George Tchobanoglous, H. David Stensel	5th Edition	McGraw-Hill Education	2014

EBooks and online course materials:

1. **https://www.google.co.in/books/edition/Water_and_Wastewater_Engineering/evcEQgAACAAJ?hl=en**
2. https://www.google.co.in/books/edition/Water_Supply_Engineering/74HYY31zwhQC?hl=en&gbpv=0

Online Courses and Video Lectures:

1. Wastewater Treatment and Recycling by Prof. Manoj Kumar Tiwari, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_ce105/preview

2. Urban Utilities Planning: Water Supply, Sanitation and Drainage By Prof. Debapratim Pandit,IIT Kharagpur **https://onlinecourses.nptel.ac.in/noc24_ar18/preview**

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Group activity - field visit and report submission 2. Quiz	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (25 Hours): Field Visit and Report Submission - Group Activity		Hours
1.	Estimate the future population and water demand for Hassan city or nearby town.	05
2	nearby reservoir, river intake, or borewell source and submit a detailed report on Type of intake structure, Location and selection criteria, Pumping arrangements and Protection measures against contamination.	05
3	visit a water treatment plant (WTP) and submit a detailed report along with Flow diagram of treatment plant and Function of each unit	05
4	Analyze a rainwater harvesting system in campus or nearby building, Identify system components: Catchment area, Storage tank & Recharge pit. Calculate rainwater harvesting potential	05
5	visit a sewer network. And submit a report on Sewer pipes and materials, Manholes and sewer appurtenances	05
Total		**25**
ABL2 (02 Hours): Activity 2 Details		**Hours**
1	**Assignment**	**01**
2	**Quiz**	**01**
Total		**02**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**2**	**3**											
CO2	**2**						**3**						
CO3	**2**						**3**						
CO4	**3**						**2**						**3**

Course Title	COMPOSITES & SMART MATERIALS		
Course Code	24OECV662	(L-T-P)C	(3 - 0 - 3) 3
Exam	03 Hours	Hours/Week	03
SEE	50 Marks	Total Hours	42L+48ABL=90

Course Objective: To enable students to understand the behavior, analysis, and applications of composite and smart materials.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Comprehend the basic properties and mechanical behavior of composite materials in different directions	PO1	
2	Apply laminate theory and micromechanical models to study single and multi-layer composite materials behavior and its failures	PO1	
3	Analyze the role of smart materials like sensors and actuators in enhancing structural performance	PO2	
4	Analyze smart, sustainable materials to address industry-specific problems, and work in teams to evaluate their performance and communicate their practical benefits	PO6, PO8 PO9	

MODULE-1	10 Hrs.

Introduction to Composites materials: Classifications and applications of fibers, matrix and Composite materials, Weight and Volume fraction and load distribution among constituents, minimum & critical volume fraction, Compliance & Stiffness matrices.

Self-Study component: Students shall gain knowledge about the innovative composite materials and their applications in the Civil engineering domain.

MODULE-2	11Hrs.

Anisotropic elasticity - Unidirectional and anisotropic lamina, thermo- mechanical properties, micromechanical analysis, classical composite lamination theory.Cross and angle–ply laminates, symmetric, antisymmetric and general asymmetric laminates, mechanical coupling and laminate stacking.

Self-Study component: Students shall explore appropriate websites to observe the behaviour of composite material subject to varying temperature.

MODULE-3	11 Hrs..

Analysis of simple laminated structural elements - Ply-stress and strain, lamina failure theories - first fly failure, environmental effects and manufacturing of composites-Hand layup technique, Pressure bag and Vacuum bag technique, Resin transfer moulding, Injection Moulding and Pultrusion.

Self-Study component: Students shall learn different types of composite materials and their application in aircraft design.

MODULE-4	10 Hrs.

Smart materials - Introduction, Types of smart structures, actuators & sensors, embedded & surface mounted actuators and sensors, piezoelectric coefficients, phase transition, piezoelectric constitutive relation.

Self-Study component: Students shall learn about self-healing materials used in the aircraft industry etc..

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Analysis and Performance of Fiber Composites	Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara	4th	John Willy and Sons	2017
2	Mechanic of Composite Materials	Robart M Jones	2nd	McGraw Hill Publishing Co.	1999

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	An Introduction to Composite Principles of Composite Material Mechanics Materials	Clyne, T. W., & Hull, D.	2nd	Cambridge University Press	2019
2	Principles of Composite Material Mechanics	Gibson, R. F.	4th	CRC Press	2016
3	Analysis and Performance of Fiber Composites	Agarwal, B. D., Broutman, L. J., & Chandrashekhara, K.	3rd	Wiley India	2006

EBooks and online course materials:

3. https://www.academia.edu/93600895/Smart_Structures_Theory
4. https://dokumen.pub/composite-materials-science-and-engineering-4th-ed-2019-978-3-030-28982-9-978-3-030-28983-6.html?utm_source=chatgpt.com

Online Courses and Video Lectures:

3. https://archive.nptel.ac.in/courses/105/108/105108124/
4. https://nptel.ac.in/courses/112104173

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted Work in a team to choose a smart material and explain how it can be used to solve a problem in a specific industry (like automobiles, space, medical, or construction). Describe how it works, why it's better than regular materials, and what benefits it offers.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Work in a team to choose a smart material and explain how it can be used to solve a problem in a specific industry	10
2	Prepare report	4
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Describe how it works, why it's better than regular materials, and what benefits it offers.	10
	Prepare report	3
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2												
CO2	3												
CO3		3											
CO4						2		2	2				

Course Title	COMPOSITES & SMART MATERIALS		
Course Code	24OECV662	(L-T-P)C	(3 - 0 - 3) 3
Exam	03 Hours	Hours/Week	03
SEE	50 Marks	Total Hours	42L+48ABL=90

Course Objective: To enable students to understand the behavior, analysis, and applications of composite and smart materials.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Comprehend the basic properties and mechanical behavior of composite materials in different directions	PO1	
2	Apply laminate theory and micromechanical models to study single and multi-layer composite materials behavior and its failures	PO1	
3	Analyze the role of smart materials like sensors and actuators in enhancing structural performance	PO2	
4	Analyze smart, sustainable materials to address industry-specific problems, and work in teams to evaluate their performance and communicate their practical benefits	PO6, PO8 PO9	

MODULE-1	10 Hrs.

Introduction to Composites materials: Classifications and applications of fibers, matrix and Composite materials, Weight and Volume fraction and load distribution among constituents, minimum & critical volume fraction, Compliance & Stiffness matrices.

Self-Study component: Students shall gain knowledge about the innovative composite materials and their applications in the Civil engineering domain.

MODULE-2	11Hrs.

Anisotropic elasticity - Unidirectional and anisotropic lamina, thermo- mechanical properties, micromechanical analysis, classical composite lamination theory.Cross and angle–ply laminates, symmetric, antisymmetric and general asymmetric laminates, mechanical coupling and laminate stacking.

Self-Study component: Students shall explore appropriate websites to observe the behaviour of composite material subject to varying temperature.

MODULE-3	11 Hrs..

Analysis of simple laminated structural elements - Ply-stress and strain, lamina failure theories - first fly failure, environmental effects and manufacturing of composites-Hand layup technique, Pressure bag and Vacuum bag technique, Resin transfer moulding, Injection Moulding and Pultrusion.

Self-Study component: Students shall learn different types of composite materials and their application in aircraft design.

MODULE-4	10 Hrs.
Smart materials - Introduction, Types of smart structures, actuators & sensors, embedded & surface mounted actuators and sensors, piezoelectric coefficients, phase transition, piezoelectric constitutive relation. ***Self-Study component: Students shall learn about self-healing materials used in the aircraft industry etc..***	

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Analysis and Performance of Fiber Composites	Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara	4th	John Willy and Sons	2017
2	Mechanic of Composite Materials	Robart M Jones	2nd	McGraw Hill Publishing Co.	1999

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	An Introduction to Composite Principles of Composite Material MechanicsMaterials	Clyne, T. W., & Hull, D.	2nd	Cambridge University Press	2019
2	Principles of Composite Material Mechanics	Gibson, R. F.	4th	CRC Press	2016
3	Analysis and Performance of Fiber Composites	Agarwal, B. D., Broutman, L. J., & Chandrashekhara, K.	3rd	Wiley India	2006

EBooks and online course materials:

5. https://www.academia.edu/93600895/Smart_Structures_Theory
6. https://dokumen.pub/composite-materials-science-and-engineering-4th-ed-2019-978-3-030-28982-9-978-3-030-28983-6.html?utm_source=chatgpt.com

Online Courses and Video Lectures:

5. https://archive.nptel.ac.in/courses/105/108/105108124/
6. https://nptel.ac.in/courses/112104173

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted Work in a team to choose a smart material and explain how it can be used to solve a problem in a specific industry (like automobiles, space, medical, or construction). Describe how it works, why it's better than regular materials, and what benefits it offers.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Work in a team to choose a smart material and explain how it can be used to solve a problem in a specific industry	10
2	Prepare report	4
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Describe how it works, why it's better than regular materials, and what benefits it offers.	10
	Prepare report	3
Total		**13**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2												
CO2	3												
CO3		3											
CO4						2		2	2				

Course Title	HAZARDOUS WASTE MANAGEMENT		
Course Code	**24OECV663**	**(L-T-P)C**	(3-0-0) 3
Exam	3Hrs	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: Foster critical thinking, problem-solving, and ethical decision-making skills necessary for addressing the complex challenges and ethical dilemmas associated with hazardous waste engineering and environmental protection.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Summarize the fundamentals of hazardous waste, relevant regulations, and the magnitude of the problem because of its improper management	PO1, PO2	
2	Assess risks for toxic substances and their adverse effects on living organisms, environment and human health	PO1, PO2	
3	Explain various physical, chemical & biological methods of treating hazardous wastes and remediation of polluted sites	PO1, PO6	
4	Estimate the concentrations of hazardous pollutants in different phases & engineering design of treatment units and disposal facilities	PO1, PO2, PO6	

MODULE-1	**11 Hrs.**

Fundamentals of Hazardous Waste Management- Definition of hazardous waste, properties and characteristics of hazardous wastes, past waste management practices, Partitioning coefficients, Conceptual Site Model, Source – Pathway – Receptor Analyses. Environmental legislations for hazardous waste disposal and land transport.

Self-study component: Students shall have a deeper understanding of hazardous waste management principles and practices.

MODULE-2	**10 Hrs..**

Risk Assessment and Waste Handling- Concept of risk and hazard, exposure pathway, calculation of risk, hazard identification, toxicity assessment, carcinogenic effects and non- carcinogenic effects, exposure assessment, applications of risk assessment, and Uncertainties. Waste minimization – factors & case studies, Solutions to major problems associated with hazardous wastes

Self-study component: students shall understand the risk assessment and waste handling.

MODULE-3	11 Hrs..
Treatment of Hazardous Wastes- Physico – chemical treatment - Stabilization, Sorption, Volatilization – Air stripping, Soil Vapor Extraction, Advanced Oxidation Process, Permeable Reactive Barrier Biological treatment - Difference between biological treatment of solid waste with hazardous waste, Composting, Bioremediation – growth kinetics, inhibition, in situ and ex situ bioremediation - Reductive dehalogenation, Bioreactors, and Constructed Wetlands ***Self-study component: students shall know different advanced treatment methods to reduce the toxic waste.***	
MODULE-4	**10 Hrs.**
Storage & Disposal of Hazardous Wastes- Treatment, Storage and Disposal Facilities (TSDFs) - Facility Design & Operation - Hazardous waste landfills – landfill design parameters, Landfill gases and leachate generation, Air strippers – operating requirements and their design aspects, Incinerators - types of devices, operating & regulatory requirements and their design aspects. ***Self-study component: students shall gain insights into current practices and emerging trends in hazardous waste storage and disposal.***	

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Waste Management Practices: Municipal, Hazardous, and Industrial.	Pichtel, J.	Second	CRC Press	2014
2.	Hazardous Waste Management.	La Grega, M. D., Buckingham, P. L., & Evans, J. C.	Third	WavelandPress.	2010

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Handbook on Chemicals and Hazardous waste manageWaste Management and Handling in India.	Bhat, S	fifth	School of India University,Bengaluru	. (2019).
2.	.Hazardous and Other Wastes (Management & Transboundary Movement) Rules. (2016).	Govt of India	first	Ministry of Environment, Forests & Climate Change, New Delhi.	2016

EBooks and online course materials:

https:NPTEL Syllabus - Solid & Hazardous Waste Management

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Field visit/Case study	7
2	Submission of Handwritten Report	7
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Presentation Content	7
2	Presentation Skill	6
Total		**13**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2											
CO2	3	2											
CO3	3					2							
CO4	3	2				2							

Course Title	SUSTAINABILITY IN ENGINEERING SYSTEMS		
Course Code	**24OECV664**	**(L-T-P) C**	(3-0-0)3
Exam	3 hours	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective:

1. Learn about the principles, indicators and general concept of sustainability.
2. Student shall be able to apply the sustainability concepts in engineering

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

#	Course Outcomes	Mapping of POs	Mapping of PSOs
1	Interpret the sustainability concepts; understand the role and responsibility of engineers in sustainable development.	PO1,PO2	
2	Utilize scientific approach to quantify and rationalize sustainability and resource availability.	PO1,PO2	
3	Make use of sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.	PO2,PO7	
4	Develop green engineering concepts and become a lifelong advocate of sustainability in society.	PO6,PO7	

MODULE-1	11 Hrs

Sustainability-Introduction, Need and impact, Glimpse into History-Millennium Development Goals and Sustainable Development Goals, Principles of Sustainable Development Goals, Current practices in SDG in Global and Indian perspective- Policy and programs. Environmental legislations in India-Related to Water and Air Act.

Self-study component: Sustainable development goals

MODULE-2	10 Hrs

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credit and carbon trading, carbon footprint Carbon sequestration – Carbon capture and storage (CCS), CO2 calculation. Environmental management standards, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking.

Self-study component: Risk assessment methods, LCA frameworks.

MODULE-3	10 Hrs

Sustainable design: Basic concepts of sustainable habitat, Green buildings, Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable Transport. Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.

Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, bio-fuels, Energy derived from oceans, Geothermal energy.

Self-study component: Green economy, Community Solutions for Sustainable Development.	
MODULE-4	**11 Hrs**
SDG Solutions: Implementing the SDGs Solutions and best practices at the individual, local, national, Measuring SDG success-Indicators, Monitoring, Evaluation, and Reporting, Challenges in implementing SDGs, Thinking beyond sustainability-Changing world-views and perspective through radical transformation. **AI & ML For sustainability:** Energy Efficiency-Smart Grids, Building Management Systems, Water Resource Management- Leak detection, demand forecasting, Sustainable Construction- Material optimization, Predictive maintenance, Climate Change Mitigation-Carbon Emission Monitoring, Environmental Impact Assessment ***Self-study component: Investigate successful state-level projects like Kerala's healthcare model and community-driven efforts such as the Sundarbans mangrove conservation project to learn about effective strategies for achieving SDGs***	

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	The Role of Agriculture and Small Farms in Economic Development, Washington	Hazell P. and Diao X	1st edition	International Food Policy Research Institute	2005
2	The End of Poverty: Economic Possibilities for Our Time	Sachs J	1st edition	Penguin	2006

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Sustainable Development for Engineers: A Handbook and Resource Guide	Karel Mulder	1st edition	Routledge	2006
2	Sustainable Design and Eco Technologies for Infrastructure: Select Proceedings of CECAR 9	Rajinder Ghai, Luh-Maan Chang, Raju Sharma, Anush K. Chandrappa	1st edition	Springer Nature	2024

EBooks and online course materials:

1. https://nptel.ac.in/courses/127105018
2. https://archive.nptel.ac.in/courses/109/106/109106200/
3. https://nptel.ac.in/courses/112104225

4. Urbanization in Western Ghats and Biodiesel: https://www.youtube.com/watch?v=uvSBN3nX2z0
5. Environmental sustainability : https://www.youtube.com/watch?v=Crd3CFq5B4s

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Details of activity 1: Group activity on different environmental issues due to anthropogenic activity. Details of activity 2 : Group activity on case study related to Sustainable solutions around the world with presentation.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (25 Hours): Field Visit and Report Submission - Group Activity		Hours
1.	Identify environmental issues in and around Hassan city caused by human activities	05
2	Conduct an in-depth study of the selected area to determine the root causes of the identified problems. Engage with stakeholders and analyze the impact on society and the environment.	05
3	Collect adequate data and perform relevant calculations related to the issue, such as population estimation, waste generation, etc.	05
4	Propose a suitable technical solution by applying sustainability concepts. Support the solution with relevant research papers and global case studies.	07
5	Prepare a PowerPoint presentation and present the findings in the classroom. Submit a comprehensive report on the topic.	03
Total		**25**
ABL2 (02 Hours): Activity 2 : Flip class		**Hours**
1	Prepare a PowerPoint presentation on the assigned topic and gather relevant subject knowledge.	01
2	Deliver the presentation in the classroom along with submission of a detailed report.	01
Total		**02**
Total ABL		**27**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**3**	**2**				**2**							
CO2	**3**	**3**				**2**	**3**						
CO3		**2**				**2**							
CO4	**3**					**2**	**3**						

Course Title	RAILWAY ENGINEERING		
Course Code	24OECV665	(L-T-P) C	(3 - 0 - 0) 3
Exam	03 Hours	Hours/Week	03
SEE	100 Marks	Total Hours	42L+48ABL=90

Course Objective: The objective of this course is to provide students with a comprehensive understanding of the principles, construction, operation and maintenance of railway systems

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Illustrate the role of railways, comparing with other modes and highlight the initiatives by Indian railways towards tourism.	PO1, PO2	–
2	Explain the various key elements of a railway track, their types and methods of surveying.	PO1, PO2, PO3	–
3	Summarize the various methods of construction, types of gradients and superelevation concept.	PO1, PO2, PO3	–
4	Suggest the methods of maintenance of track, modernization concepts and methods of reducing railway expenses.	PO1, PO2	–

MODULE-1	11 Hrs.

Introduction: Role of railways in transportation, Classifications of modes, Comparison with other modes of transportation. Historical development of railways in India. Advantages of railways. Selection of routes-preliminary and locations surveys. Classifications of Indian Railway lines, Organization of Indian Railways & production units. Initiatives by Indian Railways for development of the tourism sector.
Self-study component: Students shall visit nearby Railway station, discuss with the staff regarding the zone of that particular station. Also, collect details on the number of trains operating, financial aspects, prepare a report and submit.

MODULE-2	11 Hrs.

Permanent way: Rail – functions, classifications and types. Sleepers – functions, classifications and requirements. Ballast – functions, requirements and types. Gauges – types. Cross section of permanent way, Coning of wheel, Creep of rail, Calculation of quantity of materials needed for laying of tracks.
Self-study component: Students shall visit nearby Railway station and observe the components of railway track, rail joints, sleepers and other details, prepare a report and submit.

MODULE-3	10 Hrs.

Modernization of Railways and High Speed Trains: Modernization of Railways, Effect of High-speed Track, Ballastless Track, Metro trains, High speed Vande Bharath Trains, Vistadome coaches, Tejas Rajadhani trains, SMART coaches, NMGHS coaches, Railway electrification.

Administration of Railways: Nationalization of railways, advantages & disadvantages. Zonal administration, Railway expenses, rates & fares: Characteristics, measures to reduce expenses & railway budget. Typical railway problems,

Self-study component: Students shall visit nearby Railway station and discuss with the railway staff regarding steps taken towards modernization, zonal administration, prepare a report and submit.

MODULE-4	**10 Hrs.**

Maintenance of track: Necessity, Advantages. Maintenance of Surface of Rails, track alignment, gauge, proper-drainage, track components, Bridge and its Approaches, Rolling stock, Points and Crossings, level crossings and tunnels. Signaling during maintenance work, Speed restrictions during maintenance work, special measures for maintenance of high speed track.

Safety in Railways: Railway accidents, Classifications, Causes and prevention, Duties of railway staff in serious accidents, Emergency methods of restoring railway traffic.

Self-study component: Students shall visit nearby Railway station and discuss with the railway staff regarding track maintenance, steps taken towards safety aspects, prepare a report and submit.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Railway Engineering	SC Saxena and Arora	10	Dhanpath Rai and Sons, New Delhi	2015
2	Indian RailwayTrack	M M Agarwal	9	Oxford Publications, Bombay	2018

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Principles of Railway Engineering	Rangawala	5	Charotar Publishing House, New Delhi	2017
2	Railway Engineering	Sathish Chandra	8	Oxford University	2013

EBooks and online course materials:

1. https://onlinecourses.nptel.ac.in/noc24_ce37/preview

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 - Students shall submit the report on self study component mentioned in each module. 2) Details of activity 2 - Quiz & Assignment	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1		**Hours**
1.	Visit a nearby railway station to observe the various components of a railway track and compare them with theoretical concepts.	04
2.	Discuss the materials used in track construction and the gradients provided	04
3.	Estimate the quantity of materials required for a given length of track and compare the methodology with that adopted by the railway department, highlighting the differences	06
Total		**14**
ABL2 (13 Hours): Activity 2		**Hours**
1.	List the financial aspects of the railway station, such as ticket fares, annual profit or loss, and revenue from goods, and prepare a report	07
2.	Identify the maintenance measures implemented at the site and describe the safety measures adopted.	06
Total		**13**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**3**	**2**											
CO2	**3**	**2**											
CO3	**3**	**2**											
CO4	**3**	**2**											

Course Title	REMOTE SENSING AND GIS		
Course Code	**24OECV666**	**(L-T-P)C**	(3-0-0) 3
Exam	3 Hrs.	**Hours/Week**	3
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: To develop Knowledge on RS and GIS technologies to collect, analyze and interpret spatial data for solving real life problems.

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

#	Course Outcomes	Mapping of POs	Mapping of PSOs
1	Comprehending remote sensing entails understanding of Energy interactions	PO1,PO2	
2	Applying remote sensing in data collection and analysis through different types of sensors & platforms.	PO1,PO2	
3	Comprehend GIS : Managing , Analyzing, Visualizing spatial data solutions	PO1, PO2	
4	Develop a comprehensive report on different types of currently working satellites and their uses.	PO9, PO10	

MODULE-1 — 11 Hrs.

Introduction: Basics of Remote Sensing, Active and Passive Remote sensing (RS), Scope of remote sensing; Electromagnetic radiation and electromagnetic spectrum: Visible, Infra-Red (IR), Near IR, Middle IR, Thermal IR, and Microwave. Black body radiation and radiation laws; Interaction of EMR with atmosphere and Earth's surface features;

Types of Remote Sensing and Sensors Characteristics Platform and Orbits: Ground Based, Air Borne, Space borne. Orbits: Geo Stationary satellite, Polar Orbiting satellite. Types & characteristics of sensors, Sensor resolution, Concept of Swath and Nadir, Image referencing system, Remote sensing data products: IRS, LANDSAT, SPOT, IKONOS, Quick Bird

Self - study component: Students shall collect the information on space research organizational structure ,Types of Indian satellites, and data products

MODULE-2 — 11 Hrs.

Thermal Remote Sensing; Thermal properties of materials:

Emissivity of materials; thermal inertia of Earth surface features; Thermal data sets: LANDSAT and ASTER; Concept and Principles of microwave remote sensing; Microwave data sets SLAR. LIDAR and SAR;

Application of Thermal and Microwave data; Digital Image processing: Introduction to Image, Digital image Types of Data Products, Types of image interpretation, Basic elements of image interpretation, Visual interpretation keys, Digital Image Processing, Preprocessing, image enhancement techniques, multispectral image classification, Supervised and unsupervised.

Self-study component: Students shall collect the information on commercial and open-source Remote Sensing data for use in GIS. Download free DEM and LULC data.

MODULE-3	**10 Hrs.**

Introduction to GIS: Fundamentals of Geographic Information System: Basic Concepts: definition of GIS, Components of GIS, Variables - points, lines, polygon, Functionality of GIS, Recent trends and applications of GIS; GIS Softwares, Open-source GIS;

GIS Database: Geographic data: Spatial and non-spatial; Data models: Raster and vector; Database Management System (DBMS): Geo-database. Data Structures: Relational, hierarchical and network; Digitization of maps and imageries, Attribute data generation; Data Editing: Coordinate systems, Coordinate transformation.

Self-study component: Students shall collect the information on different commercial and open-source GIS software.

MODULE-4	**10 Hrs.**

Integrated Applications of Remote sensing and GIS

Applications in land use land cover analysis , Change detection , Water resources , Urban planning, environmental planning, Natural resource management and Traffic Management, Location based services and its applications.

Introduction to Global Positioning System (GPS): GPS satellites constellations; GPS segments: Space, Control, User; GPS antennas, signals, and codes; GPS receivers; Modes of measurements and post processing of data; Accuracy of GPS measurements; Application of GPS.

Self-study component: Students shall collect the information on different GPS system in world and their working

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Remote Sensing and Image Interpretation, 7th Edition , ISBN: 978-1-118-34328-9	Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman	7th Edition	Wiley	January 2015
2.	REMOTE SENSING AND GIS	Basudeb Bhatta	3rd Edition	OUP India	27 January 2021

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Remote sensing and Geographical information system	Anji Reddy M.	4TH EDITION	B. S. Publications 2	2012
2	Basics of remote sensing & GIS	S Kumar,	First Edition	Laxmi publications	2016
3	Remote sensing of the environment	John R. Jensen,	2nd Edition	Pearson Education	2013

EBooks and online course materials:

1. **https://science.iirs.gov.in/wp-content/uploads/2024/09/Overview_of_Remote_Sensing_and_GIS_Applications_E-Book.pdf**
2. **https://www.gisresources.com/wp-content/uploads/2013/09/anji-reddy_GIS.pdf**

Online Courses and Video Lectures:

1. **https://onlinecourses.nptel.ac.in/noc22_ce84/preview**
2. **https://archive.nptel.ac.in/courses/105/103/105103193/**
3. **https://www.iirs.gov.in/pgdiploma**

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted Details of activity : **Analysis of Remote Sensing Data Sets**: Students explore and write about various types of remote sensing data sets (e.g., optical, microwave, thermal) and their applications, discussing the advantages and limitations of each. Details of activity 2 : **GIS Theory and Case Study Presentation**: Students write a detailed case study on how GIS is used in real-world scenarios (e.g., environmental monitoring, urban planning) and present their findings.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		**Hours**
1.	Study of optical, microwave, and thermal datasets with basic concepts	5
2	Comparison of datasets based on applications, advantages, and limitations	5
3	Report writing & Discussion	4
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Introduction to GIS and selection of case study topic	4
2	Detailed study and preparation of case report	5
3	Presentation of findings and feedback	4
Total		**13**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**3**	**2**											
CO2	**3**	**2**											
CO3	**3**	**2**											
CO4									**3**	**2**			

Course Title	WATER RESOURCES MANAGEMENT		
Course Code	24OECV667	**(L-T-P) C**	(3-0-0) 3
Exam	3 Hours	**Hours/Week**	3 Hours
SEE	100 Marks	**Total Hours**	42L+48ABL=90

Course Objective: To develop an understanding of the availability and occurrence of freshwater, its uses, and problems related to water resources management

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply your understanding of the Scope and Economics of Water Resources Engineering in assessing its importance	PO1	
2	Apply Principles of Engineering Economy and Optimization in Water Resources Management	PO1	
3	Analyze Integrated Water Resource Management (IWRM) Strategies for Sustainable Development	PO2	
4	Cultivate Environmental Sustainability and Lifelong Learning in Water Resources Engineering through Project-Based Initiatives	PO6, PO11	

MODULE-1	**11 Hrs.**

MODULE-1: Water Resources – Availability, Demand and Governance

Introduction: Importance and scope of water resources management; applications of water resources engineering; global water distribution and the hydrologic cycle (conceptual treatment); water resources of the world and of India – major river basins, surface and groundwater potential;

Water demand for various purposes – domestic, irrigation, industrial, energy, ecological/environmental flows; water stress and scarcity indicators; virtual water and water footprint concepts; rejuvenation and conservation of water resources – traditional water systems of India (tanks, stepwells, johads) and modern revival efforts.

Water Law and Governance: Riparian rights, appropriative rights, permit systems and water codes; groundwater laws in India and the problem of unregulated extraction; interstate river disputes – Cauvery, Krishna, Ravi-Beas (historical background, issues, tribunal awards, present status); international water issues – Indus Waters Treaty, Brahmaputra, Nile, Colorado (overview); institutional framework – Central Water Commission, river boards, tribunals, Ministry of Jal Shakti

Self-study component: Students shall collect the information from the internet on water resource Planning, interstate river disputes, international problems. submit a report.

MODULE-2	**11Hrs.**

Module 2: Floods, Droughts and Water-Related Disasters

Floods: Importance of flood studies; definition, causes of floods and factors affecting flood flow; estimating flood magnitude – rational method and empirical formulae (simple numericals); concept of flood frequency and return period; introduction to design floods – standard project flood and probable maximum flood (conceptual treatment); structural measures – levees, reservoirs, channel improvement; non-structural measures – floodplain zoning, flood forecasting and warning systems, flood insurance; urban flooding – causes and management; case studies: Kerala 2018, Chennai 2015, Uttarakhand 2013.

Droughts: Types of droughts (meteorological, hydrological, agricultural); drought indices (conceptual); drought-prone areas of India; drought mitigation and preparedness – watershed interventions, MGNREGA-linked water works, fodder and drinking water planning.

Climate Change and Extreme Events: Impact of climate change on monsoon patterns, floods and droughts; glacial melt and Himalayan river flows; adaptation and resilience strategies.

Self-study component: Students shall collect information from the internet on causes of flood- estimation of design flood-economics of multipurpose projects-capital budgeting, submit a report.

MODULE-3	**10 Hrs.**

MODULE-3: Planning and Economics of Water Resources Projects

Planning for Water Resources Development: Definition of planning; levels and phases of planning; objectives of project planning; data requirements and water resources surveys; project formulation and evaluation; environmental and social aspects in planning – EIA basics, submergence, rehabilitation and resettlement; introduction to systems analysis in planning (conceptual); pitfalls in planning.

Engineering Economy: Steps involved in an economy study; time value of money (basic concepts); benefit-cost ratio and its application to water projects (simple numericals); economics of combined flood-control and multipurpose projects; introduction to optimization in planning and capital budgeting (conceptual overview only).

Multipurpose Projects: Functional requirements; compatibility of multipurpose uses; cost allocation methods for various uses; components of a multipurpose river basin development; operation of multipurpose reservoirs (conceptual); watershed management principles; small dams vs big dams debate; economic height of a dam (concept only).

Self-study component: Students shall collect the information from the internet on objectives of planning- cost allocation in multipurpose projects-watershed management-visit small dams, submit a report.

MODULE-4	**10 Hrs.**

MODULE-4: Integrated and Sustainable Water Resources Management

Integrated Water Resource Development: Concept and main objectives of IWRM; secondary objectives – reclamation of waterlogged areas, control of groundwater overdraft, prevention of salt-water intrusion (conceptual); integrated and conjunctive use of surface and groundwater – benefits and constraints; brief description of perspective development of Himalayan and Peninsular rivers of India; interlinking of rivers – concept, proposed links, and the debate.

Sustainable and Smart Water Management: Rainwater harvesting – rooftop and watershed level, design basics; wastewater treatment and reuse fundamentals; greywater recycling; water-efficient fixtures, pricing; urban water management concepts; role of technology – remote sensing and GIS for water resources assessment, IoT-based smart water metering and monitoring.

Organization of Water Resources Development: Present administrative structures in India and problems therein; organizational setup for execution of water resources and river basin development; role of Panchayati Raj institutions, water user associations, and community participation; national programs – Jal Jeevan Mission, Atal Bhujal Yojana, Namami Gange (overview).

Self-study component: Students shall collect the information from the internet on integrated and conjunctive use of water –water resource development of peninsular and Himalayan rivers-visit water resource department and collect details on the organizational setup.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Engineering Hydrology	Subramanya. K	5th	Tata McGraw-Hill Publishing Company Ltd., New York	2022
2	Water Resources Engineering	Linsley.K& Frozini.J.B	4th	International Students Edition, McGraw-Hill Kogakusha Ltd.	2008

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Hydrology and Water Resources Engineering	S.K Garg.	Vol 1	”Khanna Publishers, New Delhi,India	2015
2	Water Resources Systems and Management	Gupta.B.L& Amith Gupta	Vol 1	Standard Publishers & Distributors,Delhi	2008

EBooks and online course materials:

1. Handbook of Water Resources Management: Discourses, Concepts and Examples | SpringerLink

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/105/108/105108081/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	1. **ACTIVITY 1:** International and Interstate Water Disputes, Stating historical background, cause of conflict, Issue, geological aspects, present situation, importance, impacts, legal provision, conclusion 2. **ACTIVITY 2:** Students will form small groups to undertake a comprehensive project that focuses on designing a sustainable water management system for a given community or region. This project will assess students' abilities to apply theoretical knowledge to practical, real-world challenges, emphasizing sustainability, innovation, and adaptability.	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	International and Interstate Water Disputes	5
2	Stating historical background, cause of conflict, Issue, geological aspects, present situation, importance	5
3	Impacts, legal provision, conclusion - Report work	4
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Students will form small groups to undertake a comprehensive project that focuses on designing a sustainable water management system for a given community or region.	4
2	Detailed study and preparation of case report	5
3	Presentation of findings and feedback	4
Total		**13**

Course Articulation Matrix

Course Outcomes	**Program Outcomes**												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2												
CO2	3												
CO3		3											
CO4						2					2		

Course Title	ENGINEERING OPTIMIZATION		
Course Code	24OECV668	(L-T-P) C	(3-0-0) 3
Exam	3 Hours	Hours/Week	3 Hours
SEE	100 Marks	Total Hours	42

Course Objective:
To train the students with the latest and the best in the rapidly changing fields of construction engineering technology and management.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Discuss the concept and need of optimization in engineering	PO2, PO4	
2	Use conventional methods of optimization under constraints and the concept of linear programming to typical Engineering problems	PO3	
3	Apply the numerical methods for design optimization problems	PO3	
4	Apply genetic algorithms for optimum design of structural elements	PO4	

MODULE-1	10 Hrs

Classical Optimization Techniques: Engineering applications, Statement of optimization problem, Classification of optimization problems, Optimization techniques. Single variable optimization, Multivariable optimization with no constraints, with equality constraints - Lagrange multiplier - method, constrained variation method.

Self-study component: Students shall Study case studies that demonstrate the application of optimization techniques in different industries.

MODULE-2	10 Hrs

Linear Programming: Standard form of Linear programming problems, Methods of LPP-Multiple solution–graphical method, Principle of simplex method, two phase simplex method
Self-study component: Students shall Familiarize with software tools that can help solve linear programming problems, such as Microsoft Excel's Solver or Gurobi.

MODULE-3	10 Hrs

Design optimization of structural elements. Application Problems: Optimum design of steel structural elements. Algorithms for optimum designs.

Self-study component: Students shall explore and practice using any commercial software to perform structural analysis.

MODULE-4	10 Hrs

Genetic Algorithms: Introduction – Selection, Selection operator- fitness function, crossover-Encoding & Encoding Methods and mutation - Application problems.

Self-study component: Students shall Develop a fitness function that accurately reflects the objective function of the optimization problem.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Optimization Theory and Applications	Rao, S.S.	5th Edition	Wiley Eastern Limited	November 2019
2.	Optimization Methods for Engineering Design	Alan R. Parkinson, Richard J. Balling, and John D. Hedengren	2nd edition	Brigham Young University (BYU)	2018.

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Mathematical Foundations for Design: Civil Engineering Systems	**Robert M. Stark** and **Robert L. Nicholls**	Dover Ed edition	Dover Publications	2005
2	The Practical Handbook of Genetic Algorithms: Applications, Second Edition	Lance D. Chambers		CRC Press,	2008

EBooks and online course materials:

1. Engineering Optimization
2. Introduction To Genetic Algorithms
3. Genetic Algorithm applications

Online Courses and Video Lectures:

1. Operations Research (2): Optimization Algorithms
2. Optimization methods for Civil engineering

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Details of activity 1 Details of activity 2	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Formulation and solution of classical optimization problems through group activities.	5
2	Solving Linear Programming Problems using graphical and simplex methods.	5
3	Hands-on practice using Excel Solver/LINGO/Gurobi for optimization	4
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
1	Structural design optimization using optimization techniques.	4
2	Genetic Algorithm concepts and fitness function development.	5
3	Implementation of Genetic Algorithms for engineering problems.	4
Total		**13**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1		3		2									
CO2			3										
CO3			3										
CO4			2										

Course Title	ENGINEERING HYDROLOGY		
Course Code	24OECV669	(L-T-P)C	(3-0-0)3
Exam	03 Hrs	Hours/Week	3
SEE	100 Marks	Total Hours	42L+48ABL=90

Course Objective: Develop understanding about different components of the hydrological cycle
Enable the students to estimate runoff, infiltration, evaporation, groundwater flow and peak floods.
Course Outcomes: At the end of the course the student will be able to:

#	Course Outcomes	Mapping to POs
1	Understand the significance of the hydrological cycle and different sources of water and rainfall distribution.	PO1
2	Apply methods for the measurement and analysis of inflow and outflow	PO1
3	Apply stage-discharge relationships and unit hydrograph theory for flood prediction and water management.	PO1
4	Apply the knowledge of IMD, stream gauging, and groundwater monitoring stations to observe, collect data, and prepare reports to real-world hydrological systems	PO6, PO8, PO9

MODULE-1	11 Hrs.

Hydrological cycle-types of representation, Water budget equation. Climatic seasons in India. Precipitation: Definition, Types and Forms of precipitation, Rain gauges - Types, Rain gauge network, Optimum number of rain gauges. Consistency of rainfall data.

Self-study component: Students should prepare a report on following a) *visit a nearby Rain Gauge Station to observe the typical arrangements*

MODULE-2	11 Hrs.

Infiltration, Definition, processes, factors affecting infiltration. Measurement of infiltration (double ring infiltrometer), Horton's infiltration curve and infiltration indices.

Evaporation, Definition, process, factors affecting evaporation and measurement of evaporation by IS pan.

Evapo-transpiration. Definition, PET and AET, factors affecting Evapo-transpiration and estimation of Evapo-transpiration by Blaney–Criddle equation and Lysimeters.

Self-study component: Students should prepare a report: *Visit a nearby IMD station and collect layout details for rain gauge, evaporation pans, anemometer, and sunshine recorder.*

MODULE-3	10 Hrs.

Stream Gauging. Introduction Measurement of stage and velocity using current meters and float. Computation of discharge by Area-Velocity and Slope-Area methods. Simple stage–discharge curve. **Hydrograph Theory** : Definition, concept and types of hydrographs. Components of hydrograph, separation of base flow. Unit hydrograph theory, derivation and application of unit hydrograph. ***Self-study component:*** *Students should prepare a report on stream gauging station, stage discharge curve. Simple hydrograph on stream flow data of the nearby station.*
MODULE-4 **10 Hrs.**
Ground Water Hydrology and Well Hydraulics: Scope and importance of ground water and availability of groundwater. Aquifers, aquitard, aquifuge, aquiclude, perched aquifer, and Aquifer parameters, Darcy's law and its validity. Steady radial flow into a well in confined and unconfined aquifers. ***Self study component:*** *Students shall visit the District Geologist's office and learn about underground aquifers and rock formations, rainwater harvesting and recharging of underground water. Ground water level monitoring.*

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Engineering Hydrology.	Subramanya, K.		India: McGraw Hill Education (India) Private Limited.	(2013).
2	A Textbook of Hydrology.	Reddy, P. J. R.		India: University Science Press	(2011).

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	"Hydrology",	Ojha, C.S.P.,		Oxford University Press,	2008.
2	Hydrology and water resources engineering	Garg. S. K.		Khanna Publication,	2004.

EBooks and online course materials:

https://books.google.co.in/books?id=Nh8Y3vIjXK8C&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

Online Courses and Video Lectures:

https://youtu.be/IphCId7mkhk

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	27
6	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30

Activity Details	Details of activities to be conducted 1. Observation and Data Collection from IMD, Stream Gauging, and Groundwater Monitoring Stations 2. Data Analysis, Report Preparation, and Interpretation of Hydrological Observations	20
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14 Hours) : Activity 1 Details		Hours
1.	Pre-Field Preparation Introduction to IMD, CWC (Central Water Commission), and CGWB (Central Ground Water Board) monitoring systems.	8
2	Field Visit to IMD Station - Data charted analysis	6
Total		**14**
ABL2 (13 Hours): Activity 2 Details		**Hours**
	Data Compilation and Validation ● Organizing raw data from field notes into tabular formats. ● Validation and consistency checks.	4
	Data Analysis ● Graphical analysis of rainfall, streamflow, and groundwater data.	4
	Report Writing Workshop ● Guidance on structuring a hydrological report.	3
	Presentation and Review ● Group presentations of findings.	2
Total		**13**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**2**												
CO2	**3**												
CO3	**3**												
CO4						**2**		**2**	**2**				

Course Title	SOFTWARE APPLICATION LABORATORY		
Course Code	24CVL606	**(L-T-P)C**	(0-0-2) 1
Exam	3 Hrs.	**Hours/Week**	02 Hrs.
SEE	100 Marks	**Total Hours**	28P+2ABL=30

Course Objective: To equip with all necessary software skills to apply, analyze and develop engineering design in the advanced technological areas**.**

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Write programs to solve Problems in Civil Engineering using C/C++ programming / Matlab	PO1,PO2,PO5	PSO2
2	Use commercially available software packages for analysis and design of structures	PO1,PO2,PO3, PO5	PSO2
3	Use Excel programming for typical problems in Civil Engineering	PO1,PO2,PO3, PO5	

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	CAD Laboratory (Civil Engg)	Dr. G. S. Suresh and Dr. M.N. Sheshaprakash	1st	Laxmi Publications	2016
2.	CAD Laboratory	Dr. M. A. Jayaram and Dr. D. S Rajendraprasad		Sapna Publications	2003

EBooks and online course materials:

1. https://www.youtube.com/watch?v=G1GZsui9xbw
2. https://www.youtube.com/watch?v=B_fDh_xMfuo

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc20_ge05/preview
2. https://www.youtube.com/watch?v=G1GZsui9xbw
3. https://www.youtube.com/watch?v=B_fDh_xMfuo

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	One CIEs conducted for 20 marks	20

Activity Details	Details of activities to be conducted Lab Record	30
Total		**50**

Laboratory Plan:

Lab Program	Program Details
1	Writing the programs to find SF and BM and to draw BMD and SFD for the following cases due to combination of point load and UDL for Cantilever beams – Simply supported beams – Propped cantilever beams – Fixed beams.
2	Writing the programs for Design of Rectangular Singly and Doubly Reinforced RC beams by limit state method.
3	Use of commercial software packages for analysis of beams and frames.
4	Use of Spreadsheet for - Design of horizontal and vertical alignment of curves - Design of super-elevation - Computation of earthwork - Balancing of closed traverse using transit rule. Water hammer analysis- Head over Ogee weir -Verification of stability of dams - most economical section of canal, derivation of unit hydrograph and hydrograph of different base periods.
5	Using MATLAB / R-Programming / product of matrices, for matrix operations like addition, subtraction, and inverse of matrices.

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	-	-	-
4	Tutorial Component			
5	Activity Based Learning (ABL1&ABL2)	-	-	-
6	Evaluation of Learning Process	-	-	02
Total Learning Hours/Semester				**30**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test	3
Viva voce	1
Semester End Exam	3
Total	**7**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	One CIEs conducted for 20 marks	20
Activity Details	Evaluation of Lab Record	30
Total		**50**

Activity Based Learning (02 Hours)

ABL1 (01 Hour) : Activity 1 Details	Hours
Students shall prepare a report comprising of different problems on excel and Staad Pro	01
Total	**01**
ABL2 (01 Hours): Activity 2 Details	**Hours**
Students shall prepare a report comprising of different problems on MATLAB	01
Total	**01**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**3**	**2**			**3**								**2**
CO2	**3**	**2**	**2**		**3**								**2**
CO3	**3**	**2**	**2**		**3**								

Course Title	ADVANCED SURVEY TRAINING		
Course Code	24CV607	(L-T-P)C	(0-0-2) 1
Exam	3 Hrs.	Hours/Week	02
SEE	100 Marks	Total Hours	80 + 28(Site + Lab)

Course Objective: To understand the basics elements of highway, existing old tank during preliminary survey and to extract the field data using total station for the necessary calculation works.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply Surveying knowledge and advanced tools effectively to conduct reconnaissance survey for selection of site for conceptualization of projects	PO1, PO4, PO5, PO9, PO11	PSO1, PSO2
2	Design various components in Old tank, Water supply, Highway, Layout projects to prepare drawings with detailed report using total station instruments.	PO1, PO4, PO5, PO9, PO11	PSO1, PSO2

MODULE-1	27 Hrs.

Preliminary Training: During the Preliminary Training, the students will learn the following survey exercises using total station: Measurement of the distance, vertical and horizontal angles, bearings, heights, reduced Levels (RL), Transfer of data from total station to computer and vice- versa, Preparation of drawings after processing of the data.

Highway Project: Preliminary and detailed investigations to align a new road between two arbitrary points. The investigations shall consist of topographic surveying of strip of land for considering alternative routes and for deciding final alignment. Preparation of report to justify the selected alignment with details of all geometric design details. Preparation of Drawings including key plan initial alignment, final alignment, longitudinal section along with final alignment and typical cross sections of road.

MODULE-2	27 Hrs..

Layout planning of a housing colony: Works involved - Preparation of site map, Planning and marking of sites, roads, cross drainage works and amenities like: water supply, electricity, sanitation, location of GLSR, overhead tank and UGD system with STP in accordance with housing layout bylaws and statutory regulations.

MODULE-3	27 Hrs..

Survey of an existing Old Tank: Works involved -Survey of existing bund, longitudinal and cross sections showing the details of Sluice, Waste-weir and other facilities. Plotting of capacity contours. Measurement of gradient of existing channel. Preparation of drawings, indicating cross sections and locations of waste weir and sluice

MODULE-4	27 Hrs.

Marking of proposed building center line: Works involved - Selection of location for setting of the instrument. Working out the coordinates of points on centerline with reference to the instrument location. Transferring of the coordinates on to the ground.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Surveying	Basak. N. N		Tata McGraw Hill Publishing Co., ltd	2004
2	Irrigation and Water Power Engineering	Punmia, B. C		Laxmi Publications	1992

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Highway Engineering	Khanna, S. K. & Justo CES,		Nemchand Brothers,	2003
2	Water Supply Engineering	Garg, S. K.,		Khanna Publishers,	2007

EBooks and online course materials:

https://onlinecourses.nptel.ac.in/noc22_ce05/preview

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	One CIE will be conducted for 30 marks covering all the aspects of the advanced survey training camp report.	30
Activity Details	Details of activities to be conducted Submission of report containing theory part, calculations & drawings.	20
Total		**50**

Course Articulation Matrix

Course Outcomes	Program Outcomes											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3			2	3				2		1	3	3
CO2	3			2	3				2		1	3	3