Faculty of Engineering & Technology

Department of Civil Engineering

Shree Guru Gobind Singh Tricentenary University

4-Year Full Time Education Program

Bachelor of Technology in Civil Engineering (Structural Engineering/ Green Technology and Sustainable Engineering/ Construction Technology)

With effect from Year 2025

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1. NATURE AND EXTENT OF THE PROGRAM

Bachelor of Technology in Civil Engineering is an undergraduate degree program that focuses on the principles and practices of designing, constructing, and maintaining infrastructure projects.
Here are some key aspects of the Bachelor of Technology in Civil Engineering program:

Curriculum: The curriculum of a Bachelor of Technology in Civil Engineering program typically includes a combination of core engineering courses, specialized civil engineering subjects, and elective courses. Core courses may cover subjects like engineering mathematics, physics, mechanics, materials science, and computer programming. Specialized civil engineering subjects include structural engineering, geotechnical engineering, transportation engineering, water resources engineering, environmental engineering, and construction management.

Practical Training: Bachelor of Technology in Civil Engineering programs often include practical training components to give students hands-on experience. This can involve laboratory work, field visits, surveying, computer-aided design (CAD), and project work. Practical training helps students apply theoretical knowledge to real-world scenarios and develop practical skills.

Internships and Industrial Training: Many Bachelor of Technology in Civil Engineering programs incorporate internships or industrial training as part of the curriculum. This allows students to gain exposure to the industry, work on live projects, and understand the practical aspects of civil engineering under professional guidance. Internships also provide networking opportunities and enhance job prospects.

Electives and Specializations: Some Bachelor of Technology in Civil Engineering programs offer elective courses or specializations within the field. These allow students to focus on specific areas of interest, such as structural engineering, transportation planning, geotechnical engineering, environmental engineering, or construction management. Specializations provide in-depth knowledge and can help students specialize in their preferred career paths.

Project Work: Bachelor of Technology in Civil Engineering programs often require students to undertake individual or group projects. These projects can range from theoretical research to practical applications and give students an opportunity to apply their knowledge, develop problem-solving skills, and showcase their abilities.

Professional Skills and Ethics: Along with technical knowledge, Bachelor of Technology in Civil Engineering programs emphasize the development of professional skills and ethics. This includes communication skills, teamwork, project management, ethical considerations, and an understanding of sustainability and environmental aspects in engineering practices.

Bachelor of Technology in Civil Engineering provides a comprehensive education in civil engineering principles and practices, preparing students for a rewarding career in the field. It lays the foundation for further specialization through higher education or professional certifications, enabling graduates to advance their careers in specific areas of civil engineering. Here are some common modes of teaching used in Bachelor of Technology in Civil Engineering programs:

Classroom Lectures: Traditional classroom lectures are a common mode of teaching in Bachelor of Technology in Civil Engineering programs. Professors and instructors deliver lectures on various subjects, covering theoretical concepts, principles, and problem-solving techniques. Classroom lectures provide a structured learning environment and allow for direct interaction between instructors and students.

Laboratory Work: Bachelor of Technology in Civil Engineering programs often include laboratory sessions where students can apply theoretical knowledge to practical situations. These labs provide hands-on experience in conducting experiments, analyzing data, and using equipment and software relevant to civil engineering. Laboratory work helps students understand concepts better and develop practical skills.

Field Visits and Site Visits: To provide real-world exposure, Bachelor of Technology in Civil Engineering programs may include field visits or site visits to construction sites, infrastructure projects, or research facilities. These visits allow students to observe civil engineering practices in action, understand the challenges faced in the field, and gain practical insights into project execution.

Computer-Aided Design (CAD): With the advancement of technology, computer-aided design (CAD) software has become an integral part of civil engineering. B.Tech. Civil Engineering programs often include CAD courses where students learn to use software like AutoCAD, Revit, or Civil 3D for designing structures, creating engineering drawings, and analyzing models.

Project-Based Learning: Project-based learning is an effective mode of teaching in Bachelor of Technology in Civil Engineering programs. Students work on individual or group projects that simulate real-world scenarios. They apply their knowledge to solve engineering problems, design structures, analyze systems, or develop construction plans. Project-based learning enhances critical thinking, problem-solving skills, and teamwork abilities.

Seminars and Workshops: Seminars and workshops are conducted to supplement classroom learning. Experts from the industry, academia, or research institutions are invited to share their experiences, present case studies, and discuss emerging trends and technologies in civil engineering. These sessions provide students with insights into industry practices, research advancements, and current challenges.

Career Opportunities: A Bachelor of Technology in Civil Engineering degree opens up a wide range of career opportunities. Graduates can work in the construction industry, government organizations, consulting firms, research institutions, infrastructure development companies, and more. They can pursue roles such as civil engineer, structural engineer, project manager, construction manager, transportation planner, environmental engineer, or geotechnical engineer.

Construction Industry: Civil engineers play a crucial role in the construction industry. They can work in construction companies, real estate firms, or as independent consultants. Graduates can work on projects involving residential buildings, commercial complexes, infrastructure development, bridges, dams, highways, and more.

Government Sector: Civil engineers are in demand in government organizations at both the central and state levels. They can work in departments such as public works, urban planning, housing, transportation, and environmental engineering. Government jobs provide stability, attractive perks, and the opportunity to work on large-scale projects.

Infrastructure Development: With the increasing focus on infrastructure development globally, civil engineers have ample career opportunities. They can work on projects related to airports, seaports, railways, metros, power plants, water supply systems, and sewage treatment plants.

Consulting Firms: Many civil engineers work in consulting firms, providing services such as project management, structural design, geotechnical engineering, environmental impact assessment, and urban planning. Consulting firms offer diverse projects, exposure to new technologies, and the chance to work with experts in the field.

Research and Development: Civil engineering graduates can pursue a career in research and development. They can work in research institutions, universities, or join research and development departments in companies. This field focuses on innovative solutions, sustainable practices, and advancements in construction materials and technologies.

Entrepreneurship: Bachelor of Technology in Civil Engineering graduates with an entrepreneurial mindset can start their own construction companies, architectural firms, or consultancy services. This allows for independence, creativity, and the opportunity to work on projects of personal interest.

Higher Education and Teaching: Some graduates choose to pursue higher education and teaching. They can join universities as professors or research associates, imparting knowledge to future civil engineers and contributing to academic research in the field.

International Opportunities: Civil engineers have the chance to work on global projects through international organizations, construction firms, and government agencies. This provides exposure to different cultures, diverse engineering practices, and the opportunity to work on prestigious projects worldwide.

2. PROGRAM EDUCATION OBJECTIVES (PEOs)

After completing Bachelor of Technology in Civil Engineering students will be able to:

PEO No.	Education Objectives
PEO1	Apply their knowledge of mathematics, science, and engineering principles to analyze and solve complex civil engineering problems. They will have a strong foundation in areas such as structural analysis, geotechnical engineering, transportation engineering, water resources engineering, and construction management.
PEO2	To design civil engineering projects considering factors such as safety, sustainability, and economic feasibility. They will be proficient in using engineering tools, software, and techniques to design and execute projects in areas such as structural design, transportation planning, hydraulic systems, and geotechnical investigations.
PEO3	To recognize the importance of continuous learning and professional development in the field of civil engineering. They will have the ability to adapt to emerging technologies, industry trends, and changing practices, and actively seek opportunities to enhance their knowledge and skills throughout their careers.
PEO4	To understand ethical responsibilities and professional ethics in civil engineering. They will consider the environmental and societal impacts of their work and strive to incorporate sustainable practices into their designs and project execution.
PEO5	To pursue higher education in civil engineering or related fields. They will be equipped with the necessary research skills to contribute to the advancement of knowledge in civil engineering through research and development activities.
PEO6	To exhibit leadership qualities, taking initiative and assuming responsibilities in their professional roles. They will demonstrate professionalism, integrity, and effective communication skills in dealing with clients, colleagues, and stakeholders.

3. GRADUATE ATTRIBUTES

Sl. No.	Attributes	Description
1	Professional / Disciplinary Knowledge	Professional/disciplinary knowledge refers to the specific knowledge and skills acquired within a particular field or discipline. It forms the foundation of expertise and competence in a chosen profession or area of study. The development of professional/disciplinary knowledge is an essential component of graduate attributes, which are the qualities, skills, and knowledge that individuals possess upon completing their education
2	Technical / Laboratory / practical skills	Technical/laboratory/practical skills contribute to the development of attributes such as research proficiency, problem-solving ability, technical expertise, and effective communication in professional settings. Technical, laboratory, and practical skills are important components of graduate attributes, especially in fields that require hands-on expertise.
3	Communication Skill	Communication skills remark to the ability to effectively convey and exchange information, ideas, and thoughts with others. It involves both verbal and nonverbal communication techniques, as well as proficiency in various forms of written communication. Effective communication is vital in both personal and professional contexts, as it facilitates understanding, builds relationships, and resolves conflicts.
4	Cooperation/Team work	Cooperation and teamwork involve collaborating with others, pooling resources and skills, and fostering a harmonious work environment to achieve shared objectives. It requires individuals to actively contribute

		to group efforts, respect diverse perspectives, and communicate openly and effectively.
5	Professional ethics	Professional ethics encompasses a set of principles and standards that guide ethical behavior within a specific profession or field. It involves upholding integrity, honesty, and responsibility in professional interactions, decision-making, and practice
6	Research / Innovation-related Skills	Research and innovation skills involve the ability to investigate, analyze, and generate new knowledge or solutions in a particular field. These skills are crucial for advancing knowledge, addressing complex problems, and driving progress.
7	Critical thinking and problem solving	Critical thinking involves the ability to objectively analyze and evaluate information, arguments, and situations. It enables individuals to identify logical connections, recognize assumptions, and make well-informed judgments. Problem-solving, on the other hand, refers to the capacity to identify, analyze, and overcome challenges or obstacles to achieve desired outcomes
8	Reflective thinking	Reflective thinking includes introspection and analysis that allows individuals to examine their thoughts, actions, and experiences in a thoughtful and critical manner. It involves deepening one's understanding of oneself, gaining insights into strengths and areas for improvement, and making informed decisions for personal and professional growth.
9	Information/digital literacy	Information literacy refers to the ability to locate, critically evaluate, and effectively use information from diverse sources. Digital literacy, on the other hand, involves the skills to navigate, comprehend, and utilize digital technologies and tools. Together, they

		empower individuals to access, evaluate, and ethically use information in a digital environment.
10	Multi-cultural competence	Multicultural competence refers to the capacity to navigate and engage with diverse cultures in a respectful and inclusive manner. It involves developing awareness, knowledge, and skills to foster positive relationships and effective communication with individuals from different cultural backgrounds.
11	Leadership readiness/qualities	Leadership readiness and qualities are important for individuals aspiring to lead teams, projects, or organizations. Developing these attributes enhances graduate attributes such as teamwork, communication, problem-solving, and decision-making, and prepares individuals to effectively navigate the complexities of leadership roles.
12	Lifelong Learning	Lifelong learning is a fundamental graduate attribute that emphasizes the importance of continuous learning and personal development beyond formal education. It involves the willingness and commitment to acquire new knowledge, skills, and attitudes throughout one's professional and personal life. It involves the willingness and commitment to acquire new knowledge, skills, and attitudes throughout one's professional and personal life

4. QUALIFICATION DESCRIPTORS:

The qualification descriptor for Bachelor of Technology in Civil Engineering provides an overview of the knowledge, skills, and competencies that graduates of the program are expected to possess. While the specific qualification descriptors may vary among institutions, here is a general description of the qualification for Bachelor of Technology in Civil Engineering:

Knowledge Base: Graduates of Bachelor of Technology in Civil Engineering will have a comprehensive understanding of the fundamental concepts, principles, and theories in civil engineering. They will possess knowledge in areas such as structural analysis and design, geotechnical engineering, transportation engineering, water resources engineering, environmental engineering, and construction management.

Technical Skills: Graduates will have acquired technical skills relevant to civil engineering. They will be proficient in using engineering software, tools, and techniques for designing structures, analyzing systems, conducting surveys, interpreting geotechnical data, planning transportation networks, and managing construction projects.

Problem-solving Abilities: Graduates will be equipped with problem-solving skills to identify, analyze, and solve complex civil engineering problems. They will have the ability to apply critical thinking and engineering principles to develop innovative solutions, considering factors such as safety, sustainability, and economic feasibility.

Design and Implementation: Graduates will be capable of designing civil engineering projects. They will possess the skills to develop engineering drawings, create structural designs, plan transportation systems, design hydraulic systems, and implement construction projects adhering to relevant codes, regulations, and standards.

Laboratory and Fieldwork Competence: Graduates will have practical competence in conducting laboratory experiments and fieldwork related to civil engineering. They will be able to perform tests, collect data, analyze results, and interpret findings using appropriate laboratory techniques and equipment. They will also have experience in conducting surveys, site investigations, and field inspections.

Communication and Teamwork: Graduates will possess effective communication skills, both written and oral, enabling them to convey technical information clearly and professionally. They will have experience working collaboratively in multidisciplinary teams, demonstrating teamwork, leadership, and interpersonal skills.

Professional and Ethical Considerations: Graduates will understand the ethical and professional responsibilities associated with civil engineering. They will recognize the importance of sustainable practices, environmental considerations, and societal impacts in their work. They will adhere to ethical standards, codes of conduct, and legal obligations in the field of civil engineering.

Lifelong Learning: Graduates will recognize the importance of lifelong learning and continuous professional development. They will have the ability to adapt to advancements in civil engineering, engage in self-directed learning, and stay updated with emerging technologies, industry trends, and research developments.

5. PROGRAM OUTCOME

PO No.	Attribute	Competency
PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design Solutions**	Processes for problems pertaining to Civil Engineering projects in sub- and super structure construction, water treatment, highway alignment with due consideration for the structural stability and safety, durability with respect to environmental effects, cultural and societal needs of the public.
PO4	**Conduct Investigations of Complex Problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**Engineer and Society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Teamwork**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**	Communicate effectively by comprehending designs and drawings, including use of relevant codes, writing effective technical reports and make oral or written presentation as per the need of the project.
PO11	**Project Management and Finance**	Demonstrate knowledge and understanding of the civil engineering and project management principles and apply them to manage/complete within the stipulated period and funds
PO12	**Life Long Learning**	Recognize the need for and develop competencies necessary for life-long learning so as to offer enhanced knowledge and skill in the globally changing and challenging project environment.

6. PROGRAM SPECIFIC OUTCOME

PSO No.	Competency
PSO1	Apply viable aptitudes, learning in significant in the area of Structural Engineering, Water Resources Engineering, Transportation Engineering, Environmental Engineering, Geotechnical Engineering, Geo-informatics & Remote sensing, and Construction techniques & management
PSO2	Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
PSO3	Improve team building, teamwork and leadership skills of the students with high regard for ethical values and social responsibilities. Communicate effectively and demonstrate knowledge of project management and independent research.

7. COURSE STRUCTURE

SEMESTER – I

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**ESE**	**IAE**	**Total**
130101111	Engineering Mathematics-I	3	1	0	4	**40**	**60**	**100**
130101112	Programming for Problem Solving using C	2	0	0	2	**40**	**60**	**100**
130101113	Programming for Problem Solving using C Lab	0	0	2	1	**20**	**30**	**50**
130101115	Engineering Workshop Lab	0	0	4	2	**20**	**30**	**50**
	Emerging Smart Technologies for Engineers	2	0	0	2	**40**	**60**	**100**
130101117	Design Thinking & Innovation Lab	0	0	4	2	**20**	**30**	**50**
	Multidisciplinary Course (MDC)-I	3	0	0	3	**40**	**60**	**100**
	Value Added Course (VAC)-I	2	0	0	2	**20**	**30**	**50**
	Ability Enhancement Course (AEC)-I	2	0	0	2	**20**	**30**	**50**
	Total	**14**	**1**	**10**	**20**	**260**	**390**	**650**

Note– L: Lecture Hour/week, T: Tutorial Hour/week, P: Practical Hour/week, C: Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination, MDC: Multidisciplinary Course, VAC: Value Added Course, AEC: Ability Enhancement Course

SEMESTER – II

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**ESE**	**IAE**	**Total**
130102111	Engineering Mathematics-II	3	1	0	4	**40**	**60**	**100**
130102112	Basics of Electrical & Electronics Engineering	2	0	0	2	**40**	**60**	**100**
130102113	Basics of Electrical & Electronics Engineering Lab	0	0	4	2	**20**	**30**	**50**
	Engineering Physics	3	0	0	3	**40**	**60**	**100**
	Engineering Physics Lab	0	0	2	1	**20**	**30**	**50**
130102115	Engineering Graphics and Design Lab	0	0	4	2	**20**	**30**	**50**
	Multidisciplinary Course (MDC)-II	3	0	0	3	**40**	**60**	**100**
	Value Added Course (VAC)-II	2	0	0	2	**20**	**30**	**50**
	Ability Enhancement Course (AEC)-II	2	0	0	2	**20**	**30**	**50**
	Total	**15**	**1**	**10**	**21**	**260**	**390**	**650**

Note– L: Lecture Hour/week, T: Tutorial Hour/week, P: Practical Hour/week, C: Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination, MDC: Multidisciplinary Course, VAC: Value Added Course, AEC: Ability Enhancement Course

SEMESTER – III

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**ESE**	**IAE**	**Total**
	Engineering Mechanics	3	0	0	3	**40**	**60**	**100**
	Engineering Mechanics Lab	0	0	2	1	**20**	**30**	**50**
	Civil Engineering Materials	3	0	0	3	**40**	**60**	**100**
	Engineering Mathematics-III	3	0	0	3	**40**	**60**	**100**
	Hydrology	3	0	0	3	**40**	**60**	**100**
	SEC-I (Civil Engineering Drawing Lab)	0	0	4	2	**20**	**30**	**50**
	Multidisciplinary Course (MDC)-III	3	0	0	3	**40**	**60**	**100**
	Value Added Course (VAC)-III	2	0	0	2	**20**	**30**	**50**
	Ability Enhancement Course (AEC)-III	2	0	0	2	**20**	**30**	**50**
130103116	Summer Internship	0	0	2	1	**20**	**30**	**50**
	Total	**19**	**0**	**8**	**23**	**300**	**450**	**750**
Additional Credits for Specialization Structural Engineering/ Green Technology and Sustainable Engineering/ Construction Technology								
	Sustainable Building Materials and Construction Techniques	3	0	0	3	**40**	**60**	**100**
	Sustainable Building Materials and Construction Techniques Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	**22**	**0**	**10**	**27**	**360**	**540**	**900**

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SEMESTER – IV

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	ESE	IAE	Total
130104111	Structural Analysis	3	0	0	3	**40**	**60**	**100**
130104112	Fluid Mechanics	3	0	0	3	**40**	**60**	**100**
130104113	Fluid Mechanics Lab	0	0	2	1	**20**	**30**	**50**
130104114	Concrete Technology	3	0	0	3	**40**	**60**	**100**
130104115	Concrete Technology Lab	0	0	2	1	**20**	**30**	**50**
	Geomatics Engineering	2	0	0	2	**40**	**60**	**100**
	Geomatics Engineering Lab	0	0	2	1	**20**	**30**	**50**
	Engineering Chemistry	3	0	0	3	**40**	**60**	**100**
	SEC-II (GIS Lab)	0	0	4	2	**20**	**30**	**50**
	Ability Enhancement Course (AEC)-IV	2	0	0	2	**20**	**30**	**50**
	Constitution of India (MCNC)	2*	0	0	-	**-**	**-**	**-**
	Total	**16+2***	**0**	**10**	**21**	**300**	**450**	**750**
Additional Credits for Specialization Structural Engineering								
	Structural Analysis by Matrix Methods	3	0	0	3	**40**	**60**	**100**
	Structural Analysis by Matrix Methods Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Green Technology and Sustainable Engineering								
	Green Building Design and Certification Systems	3	0	0	3	**40**	**60**	**100**
	Green Building Design and Certification Systems Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Construction Technology								
	Construction Quality Control and Safety Management	3	0	0	3	**40**	**60**	**100**
	Construction Quality Control and Safety Management Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	**19+2***	**0**	**12**	**25**	**360**	**540**	**900**

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SEMESTER – V

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	ESE	IAE	Total
130105111	Reinforced Concrete Structures	3	0	0	3	**40**	**60**	**100**
	Environmental Engineering	3	0	0	3	**40**	**60**	**100**
	Environmental Engineering Lab	0	0	2	1	**20**	**30**	**50**
	Highway Engineering	3	0	0	3	**40**	**60**	**100**
	Highway Engineering Lab	0	0	2	1	**20**	**30**	**50**
	Numerical Methods	3	1	0	4	**40**	**60**	**100**
130105116	SEC-III (BIM Lab)	0	0	4	2	**20**	**30**	**50**
130105117	Industrial Training-I / MOOC Course	0	0	2	1	**20**	**30**	**50**
	Personality Development & Career Building (MCNC)	2*	0	0	-	**-**	**-**	**-**
Program Elective-I Pool (Choose One from the pool)								
	Engineering Geology	3	0	0	3	**40**	**60**	**100**
	Advance Geomatics Engineering							
	Open Channel Flow							
	Advanced Structural Analysis							
	Total	**15+2***	**1**	**10**	**21**	**280**	**420**	**700**
Additional Credits for Specialization Structural Engineering								
	Introduction to Finite Element Analysis	3	0	0	3	**40**	**60**	**100**
	Introduction to Finite Element Analysis Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Green Technology and Sustainable Engineering								
	Renewable Energy Systems in Civil Infrastructure	3	0	0	3	**40**	**60**	**100**
	Renewable Energy Systems in Civil Infrastructure Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Construction Technology								
	Building Information Modeling (BIM) and Construction Informatics	3	0	0	3	**40**	**60**	**100**
	Building Information Modeling (BIM) and Construction Informatics Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	**18+2***	**1**	**12**	**25**	**340**	**510**	**850**

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SEMESTER – VI

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	ESE	IAE	Total
	Design of Steel Structures	3	0	0	3	**40**	**60**	**100**
	Geotechnical Engineering-I	3	0	0	3	**40**	**60**	**100**
	Geotechnical Engineering-I Lab	0	0	2	1	**20**	**30**	**50**
	Irrigation Engineering	3	0	0	3	**40**	**60**	**100**
	Estimation & Costing	3	0	0	3	**40**	**60**	**100**
130106117	SEC-IV (Civil Engineering Design Lab)	0	0	4	2	**20**	**30**	**50**
	Quantitative Aptitude & Logical Reasoning (MCNC)	2*	0	0	-	**-**	**-**	**-**
Program Elective-II Pool (Choose One from the pool)								
	Introduction to Smart Cities	3	0	0	3	**40**	**60**	**100**
	Digital Image Processing							
	Ground Water Engineering							
	Advanced Reinforced Concrete Structures							
Program Elective-III Pool (Choose One from the pool)								
	Data Visualization	3	0	0	3	**40**	**60**	**100**
	Urban Transportation Planning							
	Waste Water Treatment							
	Design of Tall building							
Total		**18+2***	**0**	**6**	**21**	**280**	**420**	**700**
Additional Credits for Specialization Structural Engineering								
	Prestressed Concrete	3	0	0	3	**40**	**60**	**100**
	Prestressed Concrete Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Green Technology and Sustainable Engineering								
	Environmental Impact Assessment and Sustainable Planning	3	0	0	3	**40**	**60**	**100**
	Environmental Impact Assessment and Sustainable Planning Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Construction Technology								
	Automation and Robotics in Construction	3	0	0	3	**40**	**60**	**100**
	Automation and Robotics in Construction Lab	0	0	2	1	**20**	**30**	**50**
Total with specialization		**21+2***	**0**	**8**	**25**	**340**	**510**	**850**

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Asterisk (*) indicate that these hours will not be included in Credits.

SEMESTER – VII

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	ESE	IAE	Total
130107113	Construction Project Management	3	0	0	3	**40**	**60**	**100**
130107120	Railways, Tunnel and Airport Engineering	3	0	0	3	**40**	**60**	**100**
	Geotechnical Engineering-II	3	0	0	3	**40**	**60**	**100**
	Geotechnical Engineering-II Lab	0	0	2	1	**20**	**30**	**50**
130107115	Capstone Project	0	0	4	2	**20**	**30**	**50**
130107116	SEC-V (Valuation & Costing Lab)	0	0	4	2	**20**	**30**	**50**
130107117	Industrial Training-II/ MOOC Course	0	0	2	1	**20**	**30**	**50**
	Essence of Indian Knowledge Tradition (MCNC)	2*	0	0	0	**-**	**-**	**-**
Program Elective-V (Choose One from the pool)								
	Energy Efficient Structure	3	0	0	3	**40**	**60**	**100**
	Climate Change							
	Stochastic Hydrology							
	Bridge Engineering							
Program Elective-V (Choose One from the pool)								
	Prefabrication and 3D Printing in Construction	3	0	0	3	**40**	**60**	**100**
	New Age Transit System							
	River Engineering							
	Earthquake Engineering							
	Total	**15+2***	**0**	**12**	**21**	**280**	**420**	**700**
Additional Credits for Specialization Structural Engineering								
	Structural Dynamics	3	0	0	3	**40**	**60**	**100**
	Structural Dynamics Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Green Technology and Sustainable Engineering								
	Water and Waste Management for Sustainable Development	3	0	0	3	**40**	**60**	**100**
	Water and Waste Management for Sustainable Development Lab	0	0	2	1	**20**	**30**	**50**
Additional Credits for Specialization Construction Technology								
	Prefabrication and Modular Construction	3	0	0	3	**40**	**60**	**100**
	Prefabrication and Modular Construction Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	**18+2***	**0**	**14**	**25**	**340**	**510**	**850**

Note– L: Lecture Hour/week, T: Tutorial Hour/week, P: Practical Hour/week, C: Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination, SEC: Skill Enhancement Course, MCNC: Mandatory Course Non-Credit

Asterisk (*) indicate that these hours will not be included in Credits.

SEMESTER – VIII

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	ESE	IAE	Total
	Industrial Internship	0	0	24	12	**80**	**120**	**200**
Total with Specialization		0	0	24	12	**80**	**120**	**200**

Note – L: Lecture Hour/week, T: Tutorial Hour/week, P: Practical Hour/week, C: Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination

Multidisciplinary Courses (MDC)

Multidisciplinary Courses is credited and choice-based. The students make a choice from a pool of MDC offered by the Faculty under the University. (Reference: University Umbrella Multidisciplinary Generic Electives)

Value Added Courses (VAC)

Value Added Courses are credited and choice-based. The students make a choice from the pool of VAC offered by the Faculty under the University. (Reference: University Umbrella Value Added Courses)

Ability Enhancement Course (AEC)

Ability Enhancement Courses are credited and choice-based. The students make a choice from the pool of AEC offered by the Faculty under the University. (Reference: University Umbrella Ability Enhancement Compulsory Course)

Skill Enhancement Courses (SEC)

Skill Enhancement Compulsory Courses are credited and choice-based.

Semester III, Semester V & Semester VII

Internship

Semester	Scheme	Duration
Semester III	Summer Internship	4 Weeks after Semester II
Semester V	Industrial Training-I	6 Weeks after Semester IV
Semester VII	Industrial Training-II	6 Weeks after Semester VI

OVERALL CREDIT DISTRIBUTION TABLE (Without Specialization)

SEMESTER	HOURS PER WEEK			Total Credit	Marks Distribution		
	L	T	P	TC	ESE	IAE	Total
SEMESTER – I	14	1	10	20	260	390	650
SEMESTER – II	15	1	10	21	260	390	650
SEMESTER – III	19	0	8	23	300	450	750
SEMESTER – IV	16+2*	0	10	21	300	450	750
SEMESTER – V	15+2*	1	10	21	280	420	700
SEMESTER – VI	18+2*	0	6	21	280	420	700
SEMESTER – VII	15+2*	0	12	21	280	420	700
SEMESTER – VIII	0	0	24	12	80	120	200
Total	112+8*	3	90	160	2040	3060	5100

Note – L: Lecture Hour, T: Tutorial Hour, P: Practical Hour, TC: Total Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination. *: Mandatory Course Non-Credit.

OVERALL CREDIT DISTRIBUTION TABLE (With Specialization)

SEMESTER	HOURS PER WEEK			Total Credit	Marks Distribution		
	L	T	P	TC	ESE	IAE	Total
SEMESTER – I	14	1	10	20	260	390	650
SEMESTER – II	15	1	10	21	260	390	650
SEMESTER – III	22	0	10	27	360	540	900
SEMESTER – IV	19+2*	0	12	25	360	540	900
SEMESTER – V	18+2*	1	12	25	340	510	850
SEMESTER – VI	21+2*	0	8	25	340	510	850
SEMESTER – VII	18+2*	0	14	25	340	510	850
SEMESTER – VIII	0	0	24	12	80	120	200
Total	127+8*	3	100	180	2340	3510	5850

Note – L: Lecture Hour, T: Tutorial Hour, P: Practical Hour, TC: Total Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination. *: Mandatory Course Non-Credit.

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8. SEMESTER-WISE COURSE DETAILS

SEMESTER - I

Course Code	Course Title
	Engineering Mathematics-I
	Programming for Problem Solving using C
	Programming for Problem Solving using C Lab
	Engineering Workshop Lab
	Emerging Smart Technologies for Engineers
	Design Thinking & Innovation Lab
	Multidisciplinary Course (MDC)-I
	Value Added Course (VAC)-I
	Ability Enhancement Course (AEC)-I

FACULTY OF ENGINEERING AND TECHNOLOGY	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Mathematics-I**
Academic Year	I
Semester	I
Number of Credits	4
Course Prerequisite	+2math
Course Synopsis	To provide the students with sufficient knowledge in calculus and matrix algebra, this can be used in their respective fields.

Course Outcomes:

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

CO1	Apply elementary transformations to reduce the matrix into the echelon form and normal form to determine its rank and interpret the various solutions of system of linear equation.
CO2	Identify the special properties of a matrix such as the eigen value, eigen vector, employ orthogonal transformations to express the matrix into diagonal form, quadratic form and canonical form.
CO3	Equip themselves familiar with the functions of several variables and mean value theorems.
CO4	Familiarize with special functions to evaluate some proper and improper integrals using beta and gamma functions.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1
CO3	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1
CO4	3	1	-	-	-	-	-	-	-	-	-	1	1	-	1
Average	3	1.75	-	-	-	-	-	-	-	-	-	1	1	-	1

Course Content:

L (Hours/ Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**1**	**-**	**4**

Unit	Content and Competency	
1	Explain Matrices. (C2: Comprehension) Describe vectors: addition and scalar multiplication, matrix multiplication. (C2: Comprehension) Demonstrate Linear systems of equations and Linear Independence. (C3: Application) Identify rank of a matrix, inverse of a matrix, Symmetric, skew-symmetric and orthogonal matrices. (C1: Knowledge) Define Determinants; Eigenvalues and eigenvectors, eigen bases. (C1: Knowledge) Demonstrate Diagonalization of matrices. (C3: Application) Illustrate Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms. (C3: Application)	
2	Describe Cramer's Rule. (C2: Comprehension) Implement Gauss elimination and Gauss-Jordan elimination. (C6: Evaluation) Create Gram-Schmidt orthogonalization. (C5: Synthesis)	
3	Describe Vector Space, linear dependence of vectors, basis, dimension. (C2: Comprehension) Define Linear transformations (maps). (C1: Knowledge) Demonstrate range and kernel of a linear map. (C3: Application) Define rank and nullity. (C1: Knowledge) Explain Inverse of a linear transformation. (C2: Comprehension) Implement rank-nullity theorem. (C6: Evaluation) Describe composition of linear maps. (C2: Comprehension) Identify Matrix associated with a linear map. (C1: Knowledge)	
4	Describe Laplace Transforms & Inverse Laplace Transforms. (C2: Comprehension), Explain solution based on definition, change of scale property. (C2: Comprehension), Explain 1st & 2nd shifting properties. (C2: Comprehension), Implement LT division by t, LT of derivative, LT by multiplication by t. (C6: Evaluation), Define Convolutions & application on LT & Inverse LT. (C1: Knowledge)	

Learning Strategies and Contact Hours

Learning Strategies	**Contact Hours**
Lecture	32
Practical	
Seminar/Journal Club	2
Small Group Discussion (SGD)	2
Self-Directed Learning (SDL) / Tutorial	14
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	2
Revision	2

Others If Any:	
Total Number of Contact Hours	56

Assessment Methods:

Formative	Summative
Periodic Assessment	End Term Examination
Self Directed Learning	
Comprehensive Assessment	
Peer (Group) Activities	

Mapping of Assessment with Cos

Nature of Assessment	CO1	CO2	CO3	CO4
Periodic Assessment	✓	✓	✓	✓
Self-Directed Learning	✓	✓	✓	✓
Comprehensive Assessment	✓	✓	✓	✓
Peer (Group) Activities	✓	✓	✓	✓
End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
References:	Textbooks: 1. B. S. Grewal, "Higher Engineering Mathematics", 44/e, Khanna Publishers, 2017. 2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10/e, John Wiley& Sons, 2011.
	References: 1. N. P. Bali, "Engineering Mathematics", Lakshmi Publications. 2. George B. Thomas, Maurice D. Weir and Joel Hass, "Thomas Calculus", 13/e, Pearson Publishers, 2013. 3. H. K. Dass, "Advanced Engineering Mathematics", S. Chand and complany Pvt. Ltd.

	4. Michael Greenberg, “Advanced Engineering Mathematics”, Pearson, Second Edition.

FACULTY OF ENGINEERING AND TECHNOLOGY	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Programming for Problem Solving using C**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Understand various computer components.

Course Outcomes:

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

CO1	Understand various computer components, design flowchart and write program in C programming language.
CO2	Identify and represent numbers in different number system.
CO3	Understand, explain and use different data types and operators to write programs.
CO4	Formulate, evaluate and analyze the problems by applying programming concepts using decision control statements and loop control statements.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PS O4
CO1	1	1	1	1	-	-	-	-	-	-	-	1	**1**	-	**1**	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	**1**	-	**1**	-
CO3	-	1	-	1	-	-	-	-	-	-	-	-	**1**	-	**1**	-
CO4	1	2	1	2	2	-	-	-	3	-	1	-	**1**	-	**1**	-
Average	**1**	**1.25**	**0.5**	**1**	**0.5**	-	-	-	**0.75**		**0.5**	**0.5**	**1**		**1**	

Course Content:

L (Hours/ Week)	T (Hours/Week)	P (Hours/Week)	CL (Hours/Week)	Total Hour/Week
2	**-**	**-**	**-**	**2**

Unit	Content and Competency

1	1.Explain the Operating System [Unix, Linux, Windows]. (C2: Comprehension) 2. Explain the Programming Environment, and Write & Execute the first program. (C2: Comprehension) 3. Recall the purpose Digital Computer. (C1: Knowledge) 4. Recite the concept of an algorithm, their termination and correctness. (C1: Knowledge) 5. Analyze Algorithms to programs: specification, top-down development and stepwise refinement. (C4: Analysis) 6. Analyze Programming, Use of high level programming language for the systematic development of programs. (C4: Analysis) 7.Design and implementation of correct, efficient and maintainable programs. (C5: Synthesis) 8. Describe number systems and conversion methods. (C2: Comprehension)
2	1.Generalize the concept of Standard I/O in "C". (C5: Synthesis) 2. Explain the concepts of Data Types: Character types, Integer, short, long, unsigned, single and double-precision floating point. (C2: Comprehension) 3. Define storage classes: automatic, register, static and external. (C2: Comprehension) 4. Analyze the Operators and Expressions: Using numeric and relational operators, mixed operands and type conversion, Logical operators, and Bit operations. (C4: Analysis)
3	1. Explain the concepts of Conditional Program Execution: Applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch. (C2: Comprehension) 2. Recall the purpose and importance of Program Loops and Iteration: Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue. (C1: Knowledge) 3. Describe Modular Programming: Passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules. (C2: Comprehension) 4. Outline the purpose and significance of Arrays: Array notation and representation, manipulating array elements, using multidimensional arrays, arrays of unknown or varying size. (C1: Knowledge) 5. Explain the principles of Structures: usage of structures, declaring structures, and assigning of structures. (C2: Comprehension)
4	1. Recall the purpose and basic functions of Pointers to Objects using pointers as function arguments. (C1: Knowledge) 2. Explain the principles of Dynamic memory allocation. (C2: Comprehension) 3. Generalize the concept of Standard C Preprocessor. (C5: Synthesis) 4.Defining and calling macros. (C2: Comprehension) 5.Explain Standard C Library: Input/Output : fopen, fread, etc, string handling functions, Math functions : log, sin, alike Other Standard C functions. (C2: Comprehension)

Learning Strategies and Contact Hours

Learning Strategies	Contact Hours
Lecture	20
Practical	
Seminar/Journal Club	1
Small Group Discussion (SGD)	1
Self-Directed Learning (SDL) / Tutorial	1
Problem Based Learning (PBL)	1
Case/Project Based Learning (CBL)	2
Revision	2
Others If any:	
Total Number of Contact Hours	28

Assessment Methods:

Formative	Summative
Periodic Assessment	End Term Examination
Self Directed Learning	
Comprehensive Assessment	
Peer (Group) Activities	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Periodic Assessment	✓	✓	✓	✓
Self Directed Learning	✓	✓	✓	✓
Comprehensive Assessment	✓	✓	✓	✓
Peer (Group) Activities	✓	✓	✓	✓
End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
References:	Textbooks: 1. B. S. Grewal "Higher Engineering Mathematics" 44/e, Khanna Publishers, 2017. 2. Erwin Kreyszig "Advanced Engineering Mathematics" 10/e, John Wiley& Sons, 2011.
	References:

	1. R.K. Jain and S. R.K.Iyengar “Advanced Engineering Mathematics” 3/e, Alpha Science International Ltd., 2002. 2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas “Calculus” 13/e, Pearson Publishers, 2013

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Emerging Technologies for Smart Infrastructure**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	This course introduces students to the role of smart and sustainable technologies in shaping the infrastructure of the future. It explores how digital tools, automation, green design, and intelligent systems are transforming energy use, urban living, buildings, and transportation. Students from all engineering streams will gain foundational knowledge about smart infrastructure, emerging technologies like IoT, 3D printing, and GIS, and their relevance to sustainable development and global challenges such as climate change, urbanization, and resource scarcity.

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

CO1	Understand the importance of smart infrastructure in addressing modern urban and environmental challenges.
CO2	Identify sustainable and energy-efficient technologies applicable across infrastructure sectors.
CO3	Analyse how digital tools like IoT, sensors, BIM, and GIS contribute to smart city development.
CO4	Evaluate the role of engineering innovations in achieving sustainability and global development goals.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	1	1	1	1	2	2	1	3	1	1
CO2	3	3	3	3	2	-	-	2	1	2	2	-	3	1	1
CO3	3	3	3	2	2	-	-	2	1	2	2	-	3	1	1
CO4	3	3	3	2	1	1	-	2	1	2	2	-	3	1	1
Average	3	3	3	3	1.5	1	1	2	2	2	2	1	3	1	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
2	**0**	**0**	**2**

Unit	Content
1	Smart systems and infrastructure basics, link to climate change, rapid urbanization, and population growth (C2, Understand). Relevance of smart technologies to daily infrastructure such as roads, water, housing, and transport (C2, Understand). Introduction to energy-efficient design, resource optimization, and lifecycle thinking (C3, Apply). Case overviews: smart highways, smart homes, net-zero buildings (C3, Apply).
2	Fundamentals of green buildings and sustainable design across engineering disciplines (C2, Understand). Green rating systems (IGBC, GRIHA, LEED) simplified (C3, Apply). Introduction to Building Information Modelling (BIM) and Digital Twins (C3, Apply). Use of smart materials, automation, 3D printing, and IoT for energy management (C4, Analyse).
3	Smart cities defined: mobility, governance, housing, ICT systems (C2, Understand). Intelligent transportation, water supply, and waste systems (C3, Apply). GIS and remote sensing for planning (C3, Apply). Real-time monitoring and smart urban services (C4, Analyse). Role of engineers across disciplines in smart cities (C3, Apply).
4	Smart disaster management systems, air and water quality monitoring, sensor networks (C3, Apply). Role of renewable energy and automation in infrastructure (C4, Analyse). Ethicsin usage of smart systems (C2, Understand). Engineers' contribution to achieving SDG 11 (Sustainable Cities & Communities) (C4, Analyses).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	16
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	8
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Periodic Assessment	End Term Examination
Self Directed Learning	
Comprehensive Assessment	
Peer (Group) Activities	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Periodic Assessment	✓	✓	✓	✓
Self Directed Learning	✓	✓	✓	✓

Comprehensive Assessment	✓	✓	✓	✓
Peer (Group) Activities	✓	✓	✓	✓
End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	
References :	
	Text Books & References 1. Niraj J. Bhasin, Smart Cities – A Roadmap for Sustainable Development, McGraw-Hill 2. S.S. Ghosh, Green Building: Principles and Practices, Cengage Learning 3. Eastman et al., BIM Handbook, Wiley 4. CPWD / IGBC / GRIHA Guidelines 5. Smart Cities Mission & AMRUT Documentation (MoHUA)

Faculty of Engineering and Technology	
Name of the Department	Mechanical Engineering
Name of the Program	B. Tech.
Course Code	130301113
Course Title	**Programming for Problem Solving Lab**
Academic Year	I
Semester	I
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Understand various computer components.

Course Outcomes:

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

CO1	Understand various computer components, design flowchart and write program in C programming language.
CO2	Identify and represent numbers in different number system.
CO3	Understand, explain and use different data types and operators to write programs.
CO4	Formulate, evaluate and analyze the problems by applying programming concepts using decision control statements and loop control statements.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	-	3	1	-	-	-	-	-	1	3	2	1
CO2	3	2	2	-	-	1	-	-	-	-	2	3	3	2	-
CO3	3	2		-	-	-	-	-	-	-	1	3	3	2	-
CO4	3	2	3	3	1	-	-	-	-	-	2	3	3	2	1
Average	3.0	1.8	2.3	0.8	1.0	0.5	-	-	-	-	1.3	2.5	3.0	2.0	0.5

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**2**	**2**

Content & Competencies

Sr. No.	**Title**	
1	a) Write a C program to find sum and average of three numbers. (C1: Knowledge) b) Write a C program to find the sum of individual digits of a given positive integer. (C1: Knowledge)	

2	a) Write a C program to generate the first n terms of the Fibonacci sequence. (C1: Knowledge) b) Write a C program to generate prime numbers from 1 to n. (C1: Knowledge) c) Write a C program to check whether given number is Armstrong Number or not. (C1: Knowledge)
3	a) Write a C program to check whether given number is perfect number or not. (C1: Knowledge) b) Write a C program to check whether given number is strong number or not. (C1: Knowledge)
4	a) Write a C program to find the roots of a quadratic equation. (C1: Knowledge) b) Write a C program to perform arithmetic operations using switch statement. (C1: Knowledge)
5	a) Write a C program to find factorial of a given integer using non-recursive function. (C1: Knowledge) b) Write a C program to find factorial of a given integer using recursive function. (C1: Knowledge)
6	a) Write C program to find GCD of two integers by using recursive function. b) Write C program to find GCD of two integers using non-recursive function.
7	a) Write a C program to find both the largest and smallest number in a list of integers. (C1: Knowledge) b) Write a C program to Sort the Array in an Ascending Order. (C1: Knowledge) c) Write a C program to find whether given matrix is symmetric or not. (C1: Knowledge)
8	a) Write a C program to perform addition of two matrices. (C1: Knowledge) b) Write a C program that uses functions to perform multiplication of two Matrices. (C1: Knowledge)
9	a) Write a C program to use function to insert a sub-string in to given main string from a given position. (C1: Knowledge) b) Write a C program that uses functions to delete n Characters from a given position in a given string. (C1: Knowledge)
10	a) Write C program to count the number of lines, words and characters in a given text. (C1: Knowledge) b) Write a C program to find the sum of integer array elements using pointers. (C1: Knowledge)
11	a) Write a C program to Calculate Total and Percentage marks of a student using structure. (C1: Knowledge)
Note:	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	20
Seminar/Journal Club	--
Small Group Discussion (SGD)	--
Self-Directed Learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	4
Case/Project Based Learning (CBL)	4
Revision	--
Others If any:	--

Total Number of Contact Hours	28

Assessment Methods:

Formative	Summative
Practicals/lab/clinical proficiency	Demonstration/ Presentation
Log book/record/documentation	Viva-voce examination
Viva Voce	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practicals/lab/clinical proficiency	✓	✓	✓	✓
Log book/record/documentation	✓	✓	✓	✓
Viva Voce	✓	✓	✓	✓
Demonstration/ Presentation	✓	✓	✓	✓
Viva-voce examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback 2. Course Exit Survey

Students Feedback is taken through various steps

1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of the semester.

Textbooks:

1. YashavantKanetkar"LetUsC",BPBpublications, 2002

Balagurusamy "Programming in ANSI C" Tata McGraw-HillPublishing,1992(LatestEdition:2017)

References:

1. K. N. King "C Programming: A Modern Approach"W.WNortonandCompany,2nd Edition: 2008.
2. PetervanderLinden"ExpertCProgramming: Deep C Secrets" ,Prentice Hall, 1994

FACULTY OF ENGINEERING AND TECHNOLOGY	
Name of the Department	Computer Science and Engineering
Name of the Program	Bachelor of Technology
Course Code	130301115
Course Title	**Engineering Workshop Lab**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	None
Course Synopsis	This course introduces students to understand the basic concept of manufacturing and workshop practices, including carpentry, fitting, welding, sheet metal work, machining, and electrical circuits. Workshop lab deals with different processes by which components of a machine or equipment are made. It provides hands-on experience in using different industrial tools, measuring instruments, and fabrication processes.

Course Outcomes:

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

CO1	Identify **basic manufacturing tools and safety measures** in the workshop environment
CO2	Perform **carpentry, fitting, welding, and sheet metal operations**.
CO3	Use **lathe machines, drilling machines, and grinding machines** for basic machining operations.
CO4	Assemble **electrical and electronic circuits** and test connections.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	1	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-	-	1	1	1	-
CO4	3	2	1	-	0.75	1	-	-	-	-	-	-	1	0.25	-	-
Average	3	2	1	0.25	0.75	1	-	-	-	-	-	-	1	0.75	0.25	-

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**

0	0	4	4

Sr. No.	Content & Competencies
1	Introduction to Workshop Safety & Tools: Safety precautions, types of workshop tools, measuring instruments. (C1: Knowledge, C3: Application)
2	Carpentry Work: Cutting, shaping, and joining wood pieces to make basic joints (lap joint, mortise-tenon joint) for making a wooden bookshelf (with 2–3 tiers). (C1: Knowledge, C3: Application)
3	Fitting Work: Marking, sawing, filing, drilling, and fitting two metal pieces to form Box-Type Pen Stand. (C1: Knowledge, C3: Application)
4	Welding Practice: Arc welding techniques for making Metal Frame Utility Stool (Mini Welding Stool). (C1: Knowledge, C3: Application)
5	Sheet Metal Work: Cutting, bending, and joining sheet metal to fabricate Portable Mobile Stand (Adjustable Angle – Metal). (C1: Knowledge, C3: Application, C6: Create)
6	Machining Operations: Lathe machine operations (facing, turning, knurling) and drilling machine operations for making Metal Screwdriver Handle (Custom-Made Handle). (C1: Knowledge, C6: Create)
7	CNC Machining Basics: Introduction to Computer Numerical Control (CNC) and programming basics. (C1: Knowledge, C3: Application)
8	Aim: To design, prototype, and print 3D models using CAD software and a 3D printer for making models of Faucet handle, Cable management hive, Hot/cold water mixer, Drilling guide and dust collector, Soldering Jig (C1: Knowledge, C6: Create)
9	Aim: To explore the use of laser cutting machines for precise cutting of acrylic, wood, or metal components used in digital fabrication for making Modular Phone Stand (Flat-Pack Design), Headphone Hanger, Acrylic Keypad Lock Box (Digital Puzzle Box) (C1: Knowledge, C6: Create)
Note:	At least eight experiments/ jobs are to be performed/ prepared by students in the semester. At least five experiments/ jobs should be performed/prepared from the above list; the remaining three may either be performed/prepared from the above list or designed and set as per the scope of the syllabus of the Engineering Workshop.

Teaching Learning Strategies and Contact Hours

Learning Strategies	Contact Hours
Lecture	0
Practical	30
Seminar/Journal Club	

Small group discussion (SGD)	20
Self-directed learning (SDL) / Tutorial	
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	
Revision	
Others If any:	
Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative
Practicals/lab/clinical proficiency	Demonstration/ Presentation
Log book/record/documentation	Viva-voce examination
Viva Voce	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practicals/lab/clinical proficiency	✓	✓	✓	✓
Log book/record/documentation	✓	✓	✓	✓
Viva Voce	✓	✓	✓	✓
Demonstration/ Presentation	✓	✓	✓	✓
Viva-voce examination	✓	✓	✓	✓

Feedback Process	Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of the semester.

References:	(List of reference books)
	1. Workshop Technology Vol. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi., Vol-I: ISBN-10: 8185099146, Vol-II: ISBN: 9788185099156. 2. Workshop Technology (Manufacturing Process) –S K Garg, Laxmi Publications; Fourth Edition (2018), ISBN-10: 8131806979. 3. Principles of Manufacturing Materials and Processes - Campbell, J.S. - McGraw-Hill, New Edition, ISBN-10: 0070992525

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Design Thinking and Innovation Lab**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Design Thinking and Innovation is a practical course that introduces students to the principles and methodologies of design thinking, a human-centered approach to problem-solving. This course explores the process of identifying and solving complex problems, fostering creativity, and promoting innovation. Through hands-on exercises, projects, and case studies, students will deeply understand design thinking principles and gain practical skills to apply them in various contexts.

Course Outcomes:

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

CO1	Apply design thinking principles to generate innovative ideas and solutions.
CO2	Differentiate between traditional problem-solving and design thinking approaches.
CO3	Understand the different stages of the design thinking process and apply them in real-world scenarios.
CO4	Create prototypes for complex problems and validate them with the users.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)& Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	3	-	3	3	-	-	-	-	3	1	3	2	`1
CO2	2	3	2	-	-	2	-	-	-	-	2	3	3	2	2
CO3	2	3	2	-	-	3	-	-	-	-	1	3	3	2	2
CO4	2	3	3	3	3	2	-	-	-	-	2	3	3	2	1
Average	2	3	2.5	0.8	1.5	2.5	-	-	-	-	2	2.5	3.0	2.0	1.5

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	4	4

Sr. No.	Content & Competencies
1	**Experiment 1:** Mind Mapping Design Thinking **Module**: Introduction to Futuristic Design Thinking **Objective**: To understand the evolution, phases, and principles of design thinking. **Sample activities:** • Create a mind map illustrating the five phases of design thinking. • Analyze 2 case studies of innovation driven by design thinking. • Group discussion on key principles and their real-world relevance.
2	**Experiment 2:** Building Empathy Maps with Tech Support **Module:** Empathy in the Digital Age **Objective:** To explore user behavior, emotions, and needs using empathy tools. **Sample activities:** • Conduct an empathy interview or use a case study. • Construct a Customer Journey map for a case. • Construct a detailed empathy map (Case Study 1). • Use an online tool (e.g., Miro, FigJam) to create empathy maps collaboratively.
3	**Experiment 3:** Reframing Problems Using "How Might We" **Module:** Problem Definition and Reframing **Objective:** To learn how to define complex problems and reframe them into opportunities. **Sample activities:** • Choose a real-world issue or case and write a problem statement. • Use "5 Whys" and Fishbone diagrams to find root causes. • Develop 3-5 “How Might We” questions to reframe the problem creatively.
4	**Experiment 4:** Creative Ideation with 30 Circles **Module:** Ideation and Brainstorming **Objective:** To generate multiple innovative ideas using structured techniques. **Sample activities:** • Perform the Thirty Circles Exercise for rapid ideation. • Use SCAMPER technique on a common product (e.g., pen, bottle). • Explore AI-based tools (e.g., ChatGPT, Ideanote) to co-generate ideas.
5	**Experiment 5:** Prototyping and Testing **Module:** Prototyping and Experimentation **Objective:** To build and test low-fidelity prototypes for iterative improvement. **Sample activities:** • Select a common problem and create a mockup model prototype for a solution (e.g., ice cream stick bridge, Hydraulic elevator etc.). • Conduct a peer usability test and collect feedback.

	• Modify the prototype based on feedback and reflect on iterations.
6	**Experiment 6:** Pitching for Implementation and Scaling **Module:** Implementation and Scaling **Objective:** To learn how to present and plan for scaling a solution. **Sample activities:** • Teams develop a 1-minute elevator pitch for their prototype. • Prepare a basic implementation plan (Who, What, When, How). • Identify barriers and enablers to adoption using a SWOT matrix.
7	**Experiment 7**: Collaborative Team Challenge **Module**: Interdisciplinary Collaboration **Objective**: To experience working in cross-functional teams. **Sample activities:** • Form interdisciplinary teams and assign functional roles. • Complete a quick design challenge (e.g., design a classroom of the future). • Reflect on team dynamics and the impact of varied perspectives.
8	**Experiment 8:** Design Foresight for Emerging Tech **Module:** Future Trends in Design and Innovation **Objective:** To anticipate future trends and design for change. **Sample activities:** • Use a Futures Wheel or Foresight Canvas to explore an emerging technology's impact. • Conduct a scenario planning session for a selected industry (e.g., healthcare, transport). • Present speculative product concepts based on trends and insights.

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	15
Seminar/Journal Club	--
Small Group Discussion (SGD)	15
Self-Directed Learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	15
Case/Project Based Learning (CBL)	15
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative
Practicals/lab/clinical proficiency	Demonstration/ Presentation
Log book/record/documentation	Viva-voce examination
Viva Voce	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practicals/lab/clinical proficiency	✓	✓	✓	✓
Log book/record/documentation	✓	✓	✓	✓
Viva Voce	✓	✓	✓	✓
Demonstration/ Presentation	✓	✓	✓	✓
Viva-voce examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback 2. Course Exit Survey

Students Feedback is taken through various steps
1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.

Course Exit Survey will be taken at the end of the semester.

References:

i) Innovation By Design by Chakravarthy, BattulaKalyana, and JanakiKrishnamoorthy, Springer India, 2013, ISBN 978-81-322-0901-0

ii) Innovation by Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions by Thomas Lockwood, New Page Books, US; 1st edition (28 November 2017), ISBN: 1632651165.

iii) Innovation by Design by Gerard Gaynor, Amacom, A Division of American Management Associ135 West 50th Street New York, NY, United States, ISBN:978-0-8144-0696-0

SEMESTER - II

Course Code	Course Title
130102111	Engineering Mathematics-II
130102112	Basics of Electrical & Electronics Engineering
130102113	Basics of Electrical & Electronics Engineering Lab
	Engineering Physics
	Engineering Physics Lab
130102115	Engineering Graphics and Design Lab
	Multidisciplinary Course (MDC)-II
	Value Added Course (VAC)-II
	Ability Enhancement Course (AEC)-II

FACULTY OF ENGINEERING AND TECHNOLOGY	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Mathematics-II**
Academic Year	I
Semester	II
Number of Credits	4
Course Prerequisite	NIL
Course Synopsis	Create and analyze mathematical models using first and higher order differential equations to solve application problems such as electrical circuits, orthogonal trajectories and Newton's law of cooling and also familiarize the student in various topics in numerical analysis such as interpolation, numerical differentiation, integration and direct methods for solving linear system of equations.

Course Outcomes:

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

CO1	Demonstrate solutions to first order differential equations by various methods and solve basic application problem related to electrical circuits, orthogonal trajectory and Newton's law of cooling.
CO2	Discriminate among the structure and procedure of solving a higher order differential equations with constant coefficients and variable coefficients
CO3	Apply various numerical methods to solve linear and non-linear equations
CO4	Familiar with numerical integration and differentiation

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO4**
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	1	1	-
CO2	3	3	1	2	-	-	-	-	-	-	-	1	1	1	1	-
CO3	3	3	1	2	-	-	-	-	-	-	-	1	1	1	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	1	1	-	1	-
Average	3	1.75	1	2	-	-	-	-	-	-	-	1	1	0.75	1	-

Course Content:

L (Hours/ Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**1**	**-**	**4**

Unit	Content and Competency
1	**Probability Theory** Define probability, sample space, events, and axioms of probability. (C1: Knowledge) Explain conditional probability and Bayes' theorem, Moments, Variance of a sum (C2: Comprehension)
2	**Random Variables and Probability Distributions** Define discrete and continuous random variables. (C1: Knowledge) Illustrate probability mass function (PMF), probability density function (PDF), and cumulative distribution function (CDF). (C3: Application) Explain expectation and variance. (C2: Comprehension)
3	**Common Probability Distributions:** Describe Binomial, Poisson, and Normal distributions. (C2: Comprehension) Apply the Central Limit Theorem, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas. (C3: Application)
4	**Statistical Inference and Hypothesis Testing** Define population, sample, and sampling distributions. (C1: Knowledge) Explain confidence intervals and hypothesis testing. (C3: Comprehension) Perform t-tests, chi-square tests, and ANOVA. (C4: Application)

Teaching Learning Strategies and Contact Hours

Learning Strategies	Contact Hours
Lecture	32
Practical	
Seminar/Journal Club	2
Small Group Discussion (SGD)	2
Self-Directed Learning (SDL) / Tutorial	14
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	2
Revision	2
Others If any:	
Total Number of Contact Hours	56

Assessment Methods:

Formative	Summative
Periodic Assessment	End Term Examination
Self Directed Learning	
Comprehensive Assessment	
Peer (Group) Activities	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Periodic Assessment	✓	✓	✓	✓
Self Directed Learning	✓	✓	✓	✓
Comprehensive Assessment	✓	✓	✓	✓
Peer (Group) Activities	✓	✓	✓	✓
End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of the semester.

Textbooks:

1. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
2. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.

References:

1. Sheldon Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier.
2. Douglas C. Montgomery & George C. Runger, Applied Statistics and Probability for Engineers, Wiley.
3. Ronald E. Walpole, Probability and Statistics for Engineers and Scientists, Pearson.

FACULTY OF ENGINEERING AND TECHNOLOGY	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Basics of Electrical and Electronics Engineering**
Academic Year	I
Semester	II
Number of Credits	2
Course Prerequisite	Basic aspects of electrical engineering.
Course Synopsis	This course gives idea about basic circuit solution methods, introduction to electrical machines and basics of domestic electrical installations

Course Outcomes:

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

CO1	Understand & apply Kirchoff's laws, network theorems, time domain analysis for RL & RC series circuit.
CO2	Understand and analyze phase diagram and waveforms for purely resistive, purely inductive and purely capacitive as well as series and parallel R-L, R-C & R-L-C circuits and also circuit Resonance.
CO3	Understand concepts of Real, Reactive & apparent power and Power factor. Understand 3- phase supply and star and delta connection and their relationships.
CO4	Understand about types of batteries &its important Characteristics. Understand basic calculations for energy consumption & power factor improvement.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	-	-	1	-	-	-	-	-	-	2	-	-	-	-
CO2	3	1	-	-	1	-	-	-	-	-	-	2	-	1	1	-
CO3	3	1	-	-	1	-	-	-	-	-	-	2	-	-	1	-
CO4	1	-	1	-	-	-	-	-	-	-	-	2	-	-	-	-
Average	1.75	-	1	-	-	0.75	-	-	-	-	-	2	-	0.25	0.5	-

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**CL (Hours/Week)**	**Total Hour/Week**
2	**0**	**0**	**2**	**2**

Unit	Content	Competency
1	Explain Circuit Analysis: Ohm's Law, KCL, KVL Mesh, and nodal Analysis. (C2: Comprehension), Define Circuit parameters and energy storage aspects. (C1: Knowledge), Implement the Superposition Theorem and Thevenin's Theorem, Implement Norton's, Reciprocity, and Maximum Power Transfer Theorem, and Describe Millman's Theorem. (C2: Comprehension), Define Star-Delta Transformation. (C1: Knowledge), Application of the theorem to the Analysis of D.C. circuits. (C3: Application)	
2	Explain A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant. (C2: Comprehension), Describe Phasor representation. (C2: Comprehension), Implement Response of RL, R-C, and R-L-C circuits to sinusoidal input resonance series and parallel R-L-C Circuits. (C6: Evaluation), Explain Q-factor. (C2: Comprehension), Explain Bandwidth. (C2: Comprehension), Describe Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), (C2: Comprehension), Describe the Cathode ray tube (CRT) & its components. (C2: Comprehension), Introduction to Digital Storage Oscilloscope (DSO)	
3	Explain Semiconductor Physics: Basic concepts. (C2: Comprehension), Differentiate Intrinsic and extrinsic semiconductors. (C2: Comprehension), Differentiate diffusion and drift currents. (C2: Comprehension), Implement P-N junction diode: Ideal diode, P- N junction under open-circuit and closed-circuit. (C6: Evaluation), Describe Diode Resistance. (C2: Comprehension), Demonstrate Transition and Diffusion Capacitance. (C3: Application), Define the Effect of Temperature. (C1: Knowledge), Demonstrate Continuity Equation. (C3: Application), Explain Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes. (C2: Comprehension),Define Bipolar junction transistor. (C1: Knowledge), Describe transistors: construction, transistor operations, BJT characteristics, load line, operating point, and leakage currents. (C2: Comprehension).	
4	Introduction to DC Machines: Construction equation, Principle of operation, Different types of DC motor. (C1: Understand), Explain the speed control of shunt motor (Field and armature control), Application of DC Motors (C4: Apply), Introduction to Three phase Induction motor (Types, Principle of operation, slip torque characteristics, Applications) (C1: Understand), Introduction to Synchronous Machines and Transformers. (C1: Understand)	

Teaching Learning Strategies and Contact Hours

Learning Strategies	Contact Hours
Lecture	32
Practical	
Seminar/Journal Club	2
Small Group Discussion (SGD)	2
Self-Directed Learning (SDL) / Tutorial	14
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	2

Revision	2
Others If any:	
Total Number of Contact Hours	56

Assessment Methods:

Formative	Summative
Periodic Assessment	End Term Examination
Self Directed Learning	
Comprehensive Assessment	
Peer (Group) Activities	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Periodic Assessment	✓	✓	✓	✓
Self Directed Learning	✓	✓	✓	✓
Comprehensive Assessment	✓	✓	✓	✓
Peer (Group) Activities	✓	✓	✓	✓
End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of the semester.

Textbooks:

1. Fundamentals of Electrical Circuits by Charles k.Alexander, Mattew N.O. Saidiku, Tata McGraw Hill company.

2. V.N. Mittle "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.

3. Electrical Technology by Surinder Pal Bali, Pearson Publications.

4. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.

5. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

References:

1. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition

2. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics, and Computer Engineering", Tata McGraw Hill, Second Edition, (2006).

3. Industrial Electronics by G.K. Mittal, PHI

4. Nagsarkar T K and Sukhija MS, "Basics of Electrical Engineering", Oxford Press (2005).

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Physics**
Academic Year	I
Semester	II
Number of Credits	3
Course Prerequisite	Basic concepts of physics
Course Synopsis	This course covers quantum mechanics, crystallography, electromagnetic waves, lasers, fiber optics, superconductors, and nanomaterial, focusing on fundamental principles, key theories, and real-world applications in engineering physics.

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

CO1	Demonstrate a clear understanding of quantum mechanics principles, including blackbody radiation, Planck's law, wave-particle duality, and Schrödinger's wave equation.
CO2	Analyze crystallographic structures, X-ray diffraction techniques, and electromagnetic wave propagation in different media with theoretical and experimental perspectives.
CO3	Apply concepts of laser physics, optical fiber mechanisms, and wave propagation to understand light-based technologies and their practical applications.
CO4	Evaluate the properties, theories, and applications of superconductors and nanomaterial, exploring their technological significance and advanced material behavior.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)&Program Specific Outcomes:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	P O 6	PO 7	PO 8	PO 9	PO 10	PO1 1	P01 2	PS O 1	PS O 2	PS O 3	PS O4
CO1	3	2	1	-	1	-	-	-	-	-	-		1	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-		1	1	-	-
CO3	3	2	2	1	1	-	-	-	-	-	-		1	1	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	1	1	1	1	-
Average	3	2	1.75	1	0.75	-	-	-	-	-	-	0.25	1	1	0.25	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
2	0	0	2

Unit	Contentand Competency

1	**Quantum Theory and Wave Mechanics:** Importance of Black body radiation spectrum(C1:Knowledge) Understanding the significance of Weins law and Rayleigh- Jeans law (C1:Knowledge) Introduction to Assumption of quantum theory of radiation (C1: Knowledge- C2: Comprehension) Overview of essential Planck's law. (C1: Knowledge) Understanding Wave-particle duality (C2: Comprehension) Principles of de-Broglie matter waves (C2: Comprehension) Introduction to Bohr's quantization rule. (C2: Comprehension) Understanding the purpose and applications of Davisson-Germer experiment (C3: Application) Heisenberg uncertainty principle and its applications (C3: Application) Wave function and its significance(C3: Application) Understanding the Schrödinger's wave equation (Time dependent and time independent) - particle in one dimensional potential box, Eigen values and Eigen function. (C3: Application)
2	**Crystal Structure and Electromagnetic Wave Theory**: Overview of Space lattice, Unit cell, Lattice parameter. Seven crystal systems and Fourteen Bravais lattices. (C1: Knowledge) Explain Atomic radius and Packing factor of different cubic structures. (CI: Knowledge) Identifying Crystal structure of NaCl and diamond. (C2: Comprehension) Lattice planes and Miller Indices. (C2: Comprehension-C4: Analysis) Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer. (C2: Comprehension - C4: Analysis) Compton Effect. (C1: Knowledge-C3) EM-Wave equation and its propagation characteristics in free space, non-conducting and conducting media, energy density of electromagnetic wave. Skin depth. (C1: Knowledge-C3: Application)
3	**Laser Physics and Optical Fiber Communication**: Overview of Laser: Spontaneous and stimulated emission of radiation, population inversion. Einstein's Coefficients. (C2: Comprehension), Concept of 3 and 4 level. Laser. (C1: Knowledge) (C3: Application) Fiber Optics: Fundamental ideas about optical fiber (C1: Knowledge) Explain Propagation mechanism. (CI: Knowledge) Define Acceptance angle and cone. (C1: Knowledge) (C3: Application) Overview of Numerical aperture, Single and Multi- Mode Fibers. (C1: Knowledge) (C3: Application) Dispersion and Attenuation. (C2: Comprehension)
4	**Superconductivity and Nanoscience:** Superconductors: Temperature dependence of resistivity in superconducting materials. (C2: Comprehension) Define Effect of magnetic field (Meissner effect).(CI: Knowledge) Define Temperature dependence of critical field. (CI: Knowledge) Define London equations. (C1: Knowledge) 5. Define Josephson theory. (CI: Knowledge) Define persistent currents. (CI: Knowledge) Explain Type I and Type II superconductors. (C2: Comprehension) Define BCS theory (Qualitative).(C1: Knowledge) Explain High temperature superconductors and Applications of Superconductors. (C2: Comprehension)

	Nano-Materials: Basic principle of Nano science and technology, structure, properties and uses of Fullerene. (C2: Comprehension) Carbon nanotubes Single and double walled nanotubes, synthesis of nanotubes. Properties and Applications of nanotubes, (C2: Comprehension)

Teaching Learning Strategies and Contact Hours	
Learning Strategies	**Contact Hours**
Lecture	32
Practical	
Seminar/Journal Club	2
Small group discussion (SGD)	2
Self-directed learning (SDL)/Tutorial	1
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	2
Revision	4
Others If any:	
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Periodic Assessment	End Term Examination
Self-Directed Learning	
Comprehensive Assessment	
Peer (Group) Activities	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Periodic Assessment	✓	✓	✓	✓
Self-Directed Learning	✓	✓	✓	✓
Comprehensive Assessment	✓	✓	✓	✓
Peer (Group) Activities	✓	✓	✓	✓
End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through the Mentor Mentee system.	

2. Feedback between the semester through google forms. 3. Course Exit Survey will be taken at the end of the semester.
Textbooks: 1.Concepts of Modern Physics by Arthur Beiser 2.Solid State Physics by S.O. Pillai 3. Optics by Ajoy Ghatak
References: 1.Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles by Robert Eisberg and Robert Resnick 2.Solid State Physics by Neil W. Ashcroft and N. David Mermin 3.Introduction to Superconductivity by Michael Tinkham

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Basics of Electrical and Electronics Engineering Lab**
Academic Year	I
Semester	II
Number of Credits	2
Course Prerequisite	+2 Physics
Course Synopsis	To design electrical systems. To analyze a given network by applying various network theorems. To know the response of electrical circuits for different excitations. To study various electrical measuring instruments and transducers. To summarize the performance characteristics of electrical machines

Course Outcomes:

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

CO1	Understand the basic concepts and terminology of electrical quantities
CO2	Analyze the DC circuit using various network theorems
CO3	Understand the response of different types of electrical circuits to different excitations
CO4	Understand the measurement, calculation and relation between the basic electrical parameter.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	1	0	3	-	-	-	-	2	-	-	3	2	1
CO2	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
CO3	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
CO4	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
Average	2	0.75	1	0.75	3	-	-	-	-	2	-	-	3.0	2.0	1

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**4**	**4**

Content & Competencies	
Unit	**Title**
1	Familiarization of electrical Elements, sources, measuring devices and Transducers related to electrical circuits. (C1: Knowledge)
2	Verification of KVL and KCL. (C6: Evaluation)
3	Verification of Thevenin's and Norton's theorems. (C6: Evaluation)
4	Verification of superposition theorem. (C6: Evaluation)
5	Verification of maximum power transfer theorem. (C6: Evaluation)
6	Calculations and Verification of Impedance and Current of RL, RC, and RLC series circuits. (C6: Evaluation)
7	To study I-V characteristics of PN Diode. (C6: Evaluation)
8	To study I-V characteristics of Zener Diode. (C6: Evaluation)
9	Verification of the Truth Table of Gates. (C6: Evaluation)
10	To study O.C and S.C tests on transformer. (C6: Evaluation)
11	To study various types of meters. (C1: Knowledge)
12	To study the working of DC machines. (C1: Knowledge)
13	To perform direct load test of a transformer and plot efficiency v/s load characteristics. (C6: Evaluation
14	Measurement of power in a 3-phase system by two wattmeter method
15	To perform the speed control of DC motor

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	30
Seminar/Journal Club	--
Small Group Discussion (SGD)	20
Self-Directed Learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative
Practicals/lab/clinical proficiency	Demonstration/ Presentation
Log book/record/documentation	Viva-voce examination
Viva Voce	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practicals/lab/clinical proficiency	✓	✓	✓	✓
Log book/record/documentation	✓	✓	✓	✓
Viva Voce	✓	✓	✓	✓
Demonstration/ Presentation	✓	✓	✓	✓
Viva-voce examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback 2. Course Exit Survey

Students Feedback is taken through various steps

1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of the semester.

Textbooks:

1. **"Engineering Physics "by H.K. Malik and A.K. Singh** –Covers semiconductor physics, optics, and magnetism with a practical approach.
2. **"Practical Physics" by S.L. Gupta and V. Kumar**–A great resource for experimental techniques and detailed lab procedures.
3. **"A Textbook of Engineering Physics "by M.N. Avadhanulu and P.G. Kshirsagar** – Comprehensive coverage of theory and experiments with clear explanations.

Reference Books:

1. **"ConceptsofModernPhysics"byArthurBeiser**–Usefulforunderstandingthesolid-state physics and semiconductor concepts behind the experiments.

2. **"Optics"byAjoyGhatak**–Afantasticreferenceforexperimentsrelatedtowavelength, diffraction, and optical measurements.

"IntroductiontoElectrodynamics"byDavidJ.Griffiths–Idealfordeeperinsightsinto magnetic fields, permeability, and susceptibility.

FACULTYOFENGINEERINGANDTECHNOLOGY	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Physics Lab**
Academic Year	I
Semester	II
Number of Credits	1
Course Prerequisite	Basic concepts of physics
Course Synopsis	This course focuses on experimental techniques to study semiconductor properties, magnetic materials, optics, and spectroscopy. Students will explore concepts like Hall Effect, energy bandgap, magnetic susceptibility, diffraction, and polarization.

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

CO1	Determine semiconductor properties using Hall Effect and related techniques.
CO2	Measure optical parameters like wavelength and specific rotation.
CO3	Analyze magnetic properties, including susceptibility and permeability.
CO4	Use advanced lab equipment for precise measurements and data analysis.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)& Program Specific Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO 2	PSO 3	PS O4
CO1	3	2	1	-	-	-	-	-	-	-	-		1	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-		1	1	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-		1	1	1	-
CO4	3	2	1	-	0.75	1	-	-	-	-	-		1	0.25	-	-
Average	3	2	1	0.25	0.75	1	-	-	-	-	-		1	0.75	0.25	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	2	2

Unit	Content and Competency	COs
1	To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor using Hall Effect set up. (C1: Knowledge) (C3: Application)	
2	To determine the energy band gap of a given semiconductor material. (C1: Knowledge) (C3: Application)	
3	To draw hysteresis curve of a given sample of ferromagnetic material and from thistodeterminemagneticsusceptibilityandpermeabilityofthegivenspecimen.	
4	To determine the wavelength of monochromatic light by Newton's ring. (C1: Knowledge) (C3: Application)	
5	To determine the specific rotation of cane sugar solution using polarimeter. (C1: Knowledge) (C3: Application)	
6	To determine the wavelength of spectral lines using plane transmission grating. (CI: Knowledge) (C3: Application)	
7	Measurement of Wavelength of a laser (He-Ne) light using single slit diffraction. (CI: Knowledge) (C3: Application)	
8	To determine the specific resistance of a given wire using Carey Foster's bridge. (C1: Knowledge) (C3: Application)	
9	To study the variation of magnetic field along the axis of current carrying - Circular coil and then to estimate the radius of the coil. (C1: Knowledge) (C3: Application)	
10	To study the Magnetic Susceptibility of paramagnetic solution.	

Learning Strategies and Contact Hours

Learning Strategies	Contact Hours

Lecture	20
Practical	
Seminar/Journal Club	1
Small Group Discussion (SGD)	1
Self-Directed Learning (SDL) / Tutorial	1
Problem Based Learning (PBL)	1
Case/Project Based Learning (CBL)	2
Revision	2
Others If any:	
Total Number of Contact Hours	28

Assessment Methods:

Formative	Summative
Practicals/lab/clinical proficiency	Demonstration/ Presentation
Log book/record/documentation	Viva-voce examination
Viva Voce	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practicals/lab/clinical proficiency	✓	✓	✓	✓
Log book/record/documentation	✓	✓	✓	✓
Viva Voce	✓	✓	✓	✓
Demonstration/ Presentation	✓	✓	✓	✓
Viva-voce examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of the semester.

References:

Textbooks:

1. Engineering Physics by H.K. Malik and A.K. Singh
2. "Practical Physics" by S.L. Gupta and V. Kumar
3. "A Textbook of Engineering Physics" by M.N. Avadhanulu and P.G. Kshirsagar

	References: 1. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker 2. Introduction to Electrodynamics by David J. Griffiths 3. Practical Physics by G.L. Squires

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Graphics and Design Lab**
Academic Year	I
Semester	II
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Engineering Graphics and Design is considered the language of engineers. This course is introduced to provide basic understanding of the importance of designing aspects in engineering applications. The topics are covered in a sequence and start from the basic concepts of introduction to computer-aided design and then designing of planes and solids. Towards the end of the course, it is expected that students would be matured to visualize the engineering components from any drawing sheet, followed by the projection techniques. A number of chosen problems will be solved to illustrate the concepts clearly.

Course Outcomes:

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

CO1	Understand the use of drawing instruments and dimensioning of given drawings.
CO2	Acquire visualization skills and use of projection methods.
CO3	Able to draw different views using projection of lines, planes and solids.
CO4	Use of edges, vertices and curves to construct the drawing.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)& Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	-	1	0	3	-	-	-	-	2	-	-	3	2	1
CO2	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
CO3	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
CO4	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
Average	2	0.75	1	0.75	3	-	-	-	-	2	-	-	3.0	2.0	1

<table>
<tr><td colspan="5"></td></tr>
<tr><td colspan="5">Course Content:</td></tr>
<tr><td colspan="2">L (Hours/Week)</td><td>T (Hours/Week)</td><td>P (Hours/Week)</td><td>Total Hour/Week</td></tr>
<tr><td colspan="2">0</td><td>0</td><td>4</td><td>4</td></tr>
<tr><td>Unit</td><td colspan="4">Content & Competencies</td></tr>
<tr><td>1</td><td colspan="4">Study and Application of Different Types of Lines

Concept: Types of Lines & Their Use in Engineering Drawings
Cognitive Level: C1–C3
Introduction: Understand the purpose of different lines (e.g., visible, hidden, center, section) used in technical drawings.
Activities:

• Draw and label different lines (with appropriate thickness and style).
• Apply each type in sketching a simple machine part (e.g., bracket).
• Discuss where each line type is used practically.</td></tr>
<tr><td>2</td><td colspan="4">Use of Drawing Instruments and Design Sheet Layout

Concept: Manual Drawing Tools, Sheet Layout, Lettering & Dimensioning
Cognitive Level: C1–C4
Introduction: Develop familiarity with drafting tools, layout methods, and standardized lettering/dimensioning.
Activities:

• Set up a drawing sheet with borders, title block, and nameplate.
• Practice uniform lettering (uppercase, ISO style) and dimension a simple shape.
• Measure and dimension a physical object (e.g., eraser or nut).</td></tr>
<tr><td>3</td><td colspan="4">AutoCAD Drawing Commands Practice

Concept: 2D CAD Drawing Basics
Cognitive Level: C1–C4
Introduction: Use CAD tools to construct precise 2D geometric figures.
Activities:

• Practice commands: LINE, CIRCLE, TRIM, OFFSET, MIRROR, DIM, HATCH, etc.
• Create a drawing of a simple flange or key using AutoCAD.
• Apply layers and annotations to make the drawing industry-compliant.</td></tr>
</table>

4	**Projection of Points in Four Quadrants** **Concept:** Orthographic Projection of Points **Cognitive Level:** C1–C3 **Introduction:** Learn how to represent a point in all four quadrants with respect to HP and VP. **Activities:** • Draw projections of points placed in each of the four quadrants. • Label front and top views and locate the reference line (XY). • Identify quadrant based on projection distances. • Study drawings in different angles.
5	**Projection of Straight Lines** **Concept:** Lines Parallel, Inclined, Perpendicular; Traces **Cognitive Level:** C1–C3 **Introduction:** Understand the projection of lines in various orientations and their traces. **Activities:** • Draw lines parallel and inclined to HP/VP and both. • Mark true length, apparent length, and traces (HT/VT). • Use auxiliary plane if needed for true length. • Draw and study given cases in AutoCAD software.
6	**Projection of Planes** **Concept:** Projection of Planar Surfaces **Cognitive Level:** C1–C3 **Introduction:** Represent square, circular, and polygonal planes in various orientations. **Activities:** • Draw top and front views of planes inclined/perpendicular to HP/VP. • Identify true shape and apparent shape. • Use change of position method or auxiliary view. • Draw and study given cases in AutoCAD software.
7	**Projection of Cones and Cylinders** **Concept:** Solids with Axes at Different Orientations **Cognitive Level:** C1–C3 **Introduction:** Visualize and draw solid objects when placed in various orientations. **Activities:**

	• Draw front and top views of a cone and cylinder with axis: a) Perpendicular to HP b) Parallel to VP c) Inclined to one plane • Indicate base, axis, and apex clearly. • Draw and study given cylindrical objects/machine components in AutoCAD software.
8	**Projection of Prisms and Pyramids** **Concept:** Projection of Polyhedral Solids **Cognitive Level:** C1–C3 **Introduction:** Extend solid projection techniques to pyramids and prisms. **Activities:** • Draw projection of solids placed with bases on HP/VP and inclined axes. • Use auxiliary method to show inclined views. • Label visible and hidden edges.• • Draw and study given prismatic objects/machine components in AutoCAD software.
9	**Orthographic Projection of Machine Elements** **Concept:** Multiview Drawing (Front, Top, Side) **Cognitive Level:** C1–C4 **Introduction:** Convert 3D objects to standard 2D orthographic views. **Activities:** • Create orthographic views (at least 2) of a machine part (e.g., clamp, nut, bracket). • Use object lines, center lines, hidden lines properly. • Apply dimensioning standards (ISO or BIS).
10	**Isometric Projection of Machine Components** **Concept:** 3D Representation from 2D Views **Cognitive Level:** C1–C4 **Introduction:** Visualize and draw 3D isometric views from orthographic projections. **Activities:** • Convert given 2D orthographic views into an **isometric view**. • Use isometric axes and correct angles (30°) for drawing. • Practice using isometric scales.

11	**Sectional Views of Machine Elements** **Concept:** Internal Features via Sectioning **Cognitive Level:** C1–C4 **Introduction:** Develop the ability to expose and interpret internal features using sectional views. **Activities:** • Draw full/half sectional views of a solid object or machine part. • Apply standard hatching to the cut area. • Identify and label key features such as ribs, holes, or keyways.
Note:	1. At least ten jobs are to be performed/ prepared by students in the semester, either using AutoCAD software or on Drawing sheets using drawing instruments.

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	30
Seminar/Journal Club	--
Small Group Discussion (SGD)	20
Self-Directed Learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	**Summative**
Practicals/lab/clinical proficiency	Demonstration/ Presentation
Log book/record/documentation	Viva-voce examination
Viva Voce	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practicals/lab/clinical proficiency	✓	✓	✓	✓
Log book/record/documentation	✓	✓	✓	✓
Viva Voce	✓	✓	✓	✓
Demonstration/ Presentation	✓	✓	✓	✓
Viva-voce examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through the Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of the semester.

References:	(List of reference books)
	i) Bhatt, N. D. (2019). Engineering Drawing: Plane and Solid Geometry: [in First Angle Projection Method]. India: Charotar Publishing House Pvt. Limited. ISBN: 9789380358963, 9380358962. **ii)** Dhananjay A. Jolhe (2008), "Engineering Drawing", Tata McGraw Hill Publishers. ISBN: 9780070648371, 0070648379. **iii)** JOHN, K. C. (2009). Engineering Graphics for Degree. India: PHI Learning, ISBN: 9788120337886, 8120337883.

SEMESTER - III

Course Code	Course Title
	Engineering Mechanics
	Engineering Mechanics Lab
	Civil Engineering Materials
	Engineering Mathematics-III
	Hydrology
	SEC-I (Civil Engineering Drawing Lab)
	Multidisciplinary Course (MDC)-III
	Value Added Course (VAC)-III
	Ability Enhancement Course (AEC)-III
	Summer Internship
Additional Credits for Specialization Structural Engineering/ Green Technology and Sustainable Engineering/ Construction Technology	
	Sustainable Building Materials and Construction Techniques
	Sustainable Building Materials and Construction Techniques Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Mechanics**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course introduces the basic of engineering Mechanics. This includes: Properties of materials, Stresses and strains, Shear Force, Columns and Struts, Deflection of beams and failures theory and Bending Moment. The behavior of different structural components such as beam, column, truss under different loads and forces will be analyzed.

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

CO1	Identify different materials and their behavior
CO2	Analyze various structures under different loading conditions
CO3	Apply the principles of structural mechanics in design structural elements
CO4	Apply the concepts of torsion and failure theories for design of structures

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	1	1	1	1	2	2	1	3	1	1
CO2	3	3	3	3	2	-	-	2	1	2	2	-	3	1	1
CO3	3	3	3	2	2	-	-	2	1	2	2	-	3	1	1
CO4	3	3	3	2	1	1	-	2	1	2	2	-	3	1	1
Average	3	3	3	3	1.5	1	1	2	2	2	2	1	3	1	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content
1	Define stress and its types (C1, Remember), Demonstration of stress-Strain curve for ductile and brittle material (C3, apply), Classify the elastic constants C2 (Understanding), Describe One Dimensional loading of members of varying cross sections C2 (Understanding), Discuss the Compound stresses: General state of stress, resultant stress and strain C2 (Understanding), Describe principal stresses and principal strains C2

	(Understanding), Use of Mohr's circle for determination of stresses and strains C3 (Application).
2	Introduction, shear force and bending moment: Define shear force and bending moment C1 (Remember), Demonstration and relate of shear force and bending moment diagrams for beams (C3 & C4) Describe the Failure Criteria of beams and Theory of bending C2 (Understanding), Formulate the Section modulus of rectangular and circular sections C6 (Create), Investigate the deflection of beams by Macaulay's method, moment area method and conjugate beam method C6 (Create).
3	Relate moment, slope and deflection using Moment area method, Macaulay's method and conjugate beam method C4 (Analysis), Use of these methods to calculate slope and deflection for determinant beams C3 (Application). Investigate the Criteria for stability of columns C6 (Create), Describe the Buckling of columns C2 (Understanding), Formulate the Euler's formula for various end restraints C6 (Create), State Rankin's formulaC1 (Remember)
4	Torsion: Define torsion C1 (Remember), Formulate the torsion shafts of circular section, torque and twist C6 (Create), examine the shear stress due to torque C4 (Analysis), Truss: Define and classify the truss C2 (Understanding), Investigate the solution of simple truss using Method of joints and method of sections C6 (Create).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	28
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	7
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	

Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	2. Student's Feedback
Students Feedback is taken through various steps 3. Regular feedback through Mentor Mentee system **4.** Feedback between the semester through google forms	
References:	
	Text Books: 1 Er. R.K Rajput (2011), ISBN No. 81/219/2594/0 Engineering Mechanics, 7th Edition, S Chand publications. **Reference Books:** 1.F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill. 2.R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press. 3.Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press. 4. Shames and Rao (2006), Engineering Mechanics, Pearson Education.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Mechanics Lab**
Academic Year	II
Semester	III
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Properties of materials, Stresses and strains, Shear Force, Columns and Struts, Deflection of beams and failures theory and Bending Moment

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

CO1	Understand the mechanical properties of materials such as stress, strain, and elasticity.
CO2	Analyze the different types of loads acting on a material and how they affect its strength.
CO3	Test and analyze the strength of materials using various techniques such as tension and compression testing.
CO4	Apply the principles of stress and strain analysis in real-world scenarios.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	2	-	1	1	-	-	1	1	3	1	1
CO2	3	3	3	3	2	-	1	1	-	-	1	1	3	1	1
CO3	3	3	3	3	2	-	1	1	-	-	1	1	3	1	1
CO4	3	3	3	3	2	-	1	1	-	-	1	1	3	1	1
Average	3	3	3	3	2	-	1	1	-	-	1	1	3	1	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	**0**	**2**	**2**

Experiment No.	Content
1.	Demonstrate the tension test on a mild steel and HYSD bars C3 (Application)
2.	Demonstrate compression test on Bricks C3 (Application)
3.	Investigation of elastic constant of steel beams experimentally C6 (Create)
4.	Experimental verification of Maxwell theorem C4 (Analysis)
5.	Demonstrate the compression and tension test on helical springs C3 (Application)

6.	Demonstrate the torsion test on mild steel and HYSD bars. C3 (Application)
7.	Investigate the critical buckling load and deformation of column for different end conditions C6 (Create)
8.	Experiment on the deflection of steel truss C4 (Analysis)
9.	Investigate the different end condition of column C6 (Create)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	16
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	04
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Civil Engineering Materials**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Civil Engineering Materials is a course that focuses on the principles and practices involved in the construction of buildings, and the selection, properties, and use of various materials in construction.

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

CO1	Follow BIS and NBO codes for different components of building construction along with testing procedure of building materials with respect to relevant codes.
CO2	Supervise construction work with technical ability within the frame work of codal provision.
CO3	Select the modern construction materials appropriate to the climate and functional aspects of the buildings.
CO4	Supervise the construction technique to be followed in brick and stone masonry, concreting, flooring, roofing and plastering etc.
CO5	Understand the common lapses during the construction which results in the deterioration/damage to the structure at the later date.
CO6	Study the causes of deterioration, crack pattern and assessment of damage to the structure due to faulty construction or natural calamity.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P01 2	PSO 1	PSO 2	PSO 3
CO1	3	3		3				3				3	3	2	1
CO2	3	3		3	3				3	2	3		3	2	1
CO3		3	3	3	3	2							3	1	2
CO4	3	3		3		3		2			3		3	1	2
CO5	3	3		3		3		2			1		3	1	2
CO6	3	3		3	2	1	2					3	3	1	3
Average	2.5	3	0.5	3	1.3	1.5	0.3	1.1	0.5	0.3	1.1		3	1.33	1.73

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	Content
1	Classify the different types of building materials C2 (Understanding), Discuss the Physical and Mechanical properties of construction materials such as stones, brick, cement, aggregate, timber, tiles C2 (Understanding). Test of said materials as per BIS specifications C4 (Analysis), Structural Steel and Aluminum, Roofing Material, Physical descriptions of asbestos sheets, GI sheets, tubes and light weight roofing materials, Timber and its Products, Modern materials, Neoprene, thermocol, vinyl flooring, decorative panels and laminates, anodized aluminum, architectural glass and ceramics.
2	Describe the basic facts and concepts related to brick masonry construction, stone masonry, finishing, and general principles of construction C1 (Remember), understanding the principles of construction, types of bonds in brick masonry, various types of stone masonry, methods of construction, lintels, arches, pointing, plastering, paintings, varnishing, flooring and its types, roofing and its types, and damp-proof course (DPC) C2 (Understanding) Evaluate the advantages and disadvantages of various types of bonds in brick masonry, considering factors such as structural integrity, aesthetics, and cost-effectiveness C4 (Analysis)
3	Understand the basic facts and concepts related to thermal insulation and acoustics in building construction C1 (Remember). Explaining the types of materials used for thermal insulation, such as fiberglass, foam boards, reflective insulation, and cellulose C2 (Understanding). analyze the performance and limitations of different thermal insulation materials. They can evaluate the thermal conductivity, durability, and environmental impact of materials such as fiberglass, foam boards, reflective insulation, and cellulose C4 (Analysis) assess the performance of different thermal insulation materials and methods C6 (Create) Thermal insulation- Types of materials, Heat transfer and basic definition, methods of thermal insulations for roof, exposed walls, doors and windows in building construction. Acoustics- Types of materials for improvement of acoustics in building construction, audible sound, behavior of sound, reflection of sound, reverberation and absorption, sound insulation and acoustic design of hall.
4	Understand the basic facts and concepts related to preventive measures during construction, assessment of damage to buildings, and the repair and rehabilitation of structures C2 (Understanding). Analyze the causes and consequences of faulty construction and damage to buildings C4 (Analysis) Evaluate existing preventive measures, damage assessment techniques, and repair and rehabilitation methods C6 (Create)

	Preventive measures during construction for a durable and safe building structures, assessment of damage due to faulty construction and natural and manmade calamities, repair and rehabilitation of structures

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	30
Practical	--
Seminar/Journal Club	–
Small group discussion (SGD)	5
Self-directed learning (SDL) / Tutorial	–
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Peer Group activities	✓	✓	✓	✓	✓	✓
Quiz	✓	✓	✓	✓	✓	✓
Seminars	✓	✓	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Text Books 1. Rangawala , Building Construction (2010) ISBN No. 978-93-80358-15-4,Charotar Publications Pvt. Ltd. 28th Edition **Reference books**

	1. P.C.Varghese, Engineering Materials, 1st edition, PHI Learning. 2. S.K.Duggal, Building Materials, 3rd Edition, New Age International Publishers. 3. Sushil Kumar, Building Construction, Standard Publishers Distributors. 4. M. S. Shetty, Concrete Technology: Theory and Practice, S. Chand Publishers. 5. A. R. Santhakumar, Concrete Technology, Oxford University Press.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Hydrology**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Hydrology is the study of water in the Earth's system. This course introduces students to the fundamental principles of hydrology and their application to water resource management. The course covers the basic principles of hydrologic cycle, precipitation, evapotranspiration, runoff, streamflow, and groundwater. The laboratory experiments are designed to supplement the theory covered in the course. The experiments cover measurement of streamflow, groundwater, and precipitation, as well as water quality testing.

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

CO1	The students shall learn to estimate rainfall and perform hydrograph analysis.
CO2	Extract maximum amount of water from around aquifers after locating them.
CO3	Perform calculation for flood routing for various irrigation projects.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**1**
CO2	**3**	**2**	**2**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**1**
CO3	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**1**
Average	**3.0**	**2.3**	**2.0**	**3.0**	**1.3**	**2.7**	**3.0**	**3.0**	**3.0**	**1.7**	**2.0**	**2.7**	**3**	**1.33**	**1**

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Basic understanding of hydrological cycle and rainfall measurement (C1, C2); application of hydrology to engineering problems C3 (Application);	

	explain drainage basins and its characteristics, stream geometry, hypsometric curves C2 (Understanding), compare different Types & forms of precipitation C4 (Analysis); rainfall measurements, interpretation of rainfall data C3 (Application); differentiate infiltration indices, Hydrograph analysis, Module hydrograph and Time Series Analysis C4 (Analysis), application of application of hydrograph C3 (Application); demonstrate runoff and runoff cycle C3 (Application)
2	Basic concept of evaporation Process, transpiration Process and infiltration Process C2 (Understanding), measurement of Evapo-transpiration and potential evapo-transpiration C5 (Evaluate); derive Penman`s equation C3 (Application); measurement of infiltration, infiltration indices C5 (Evaluate), demonstration of Infiltration process, initial loss, infiltration capacity C3 (Application); compare the different methods of control of reservoir evaporation C4 (Analysis), evaporimeters and empirical relationships in evaporation Process C4 (Analysis)
3	Basic concept of Ground water-Aquifers, Permeability & transmissibility C2 (Understanding); Interference among wells-well losses C3 (Application), compare well and flow irrigation C4 (Analysis); measurement of yield of an open well - Tube well & infiltration galleries C5 (Evaluate), Application of Dupits & Theims equation C3 (Application)
4	Concept of flood routing C2 (Understanding); application of flood routing for the construction of hydraulic reservoirs C3 (Application); compare the Hydrologic routing and hydraulic routing C4 (Analysis); appraise the methods of flood routing- Step by step method, trial and error method C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	28
Practical	--
Seminar/Journal Club	06
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	5
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**
Peer Group activities	✓	✓	✓
Quiz	✓	✓	✓
Seminars	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓
Comprehensive assessment	✓	✓	✓
University End Term Examination	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	
References:	
	Text Books 1. Engineering Hydrology, K Subramanian (2014), 4^{th} Edition, ISBN No. 978-1-25902997-4, Tata McGraw Hill.

FACULTY OF ENGINEERING AND TECHNOLOGY	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Mathematics-III**
Academic Year	II
Semester	III
Number of Credits	4
Course Prerequisite	NIL
Course Synopsis	Create and analyze mathematical models using first and higher order differential equations to solve application problems such as electrical circuits, orthogonal trajectories and Newton's law of cooling and also familiarize the student in various topics in numerical analysis such as interpolation, numerical differentiation, integration and direct methods for solving linear system of equations.

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

CO1	Demonstrate solutions to first order differential equations by various methods and solve basic application problem related to electrical circuits, orthogonal trajectory and Newton's law of cooling.
CO2	Discriminate among the structure and procedure of solving a higher order differential equations with constant coefficients and variable coefficients
CO3	Apply various numerical methods to solve linear and non-linear equations
CO4	Familiar with numerical integration and differentiation

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PS O4**
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	1	1	-
CO2	3	3	1	2	-	-	-	-	-	-	-	1	1	1	1	-
CO3	3	3	1	2	-	-	-	-	-	-	-	1	1	1	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	1	1	-	1	-

Average	**3**	**1.75**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**0.75**	**1**	**-**

Course Content:

L (Hours/ Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**1**	**-**	**4**

Unit	Content and Competency
1	1. Define Linear differential equations with constant coefficients: Solutions of second and higher order differential equations; Inverse differential operator method. (C1: Knowledge) 2. Explain method of undetermined coefficients and method of variation of parameters. (C2: Comprehension)
2	1. Describe Linear differential equations with variable coefficients: Solution of Cauchy's and Legendre's linear differential equations. (C2: Comprehension) 2. Define Nonlinear differential equations - Equations solvable for p, equations solvable for y, equations solvable for x, general and singular solutions. (C1: Knowledge) 3. Implement Clairauit's equations and equations reducible to Clairauit's form. (C6: Evaluation)
3	1. Describe Partial Differential equations: Formulation of Partial differential equations by elimination of arbitrary constants/functions. (C2: Comprehension) 2. Solution of non-homogeneous Partial differential equations by direct integration. (C6: Evaluation) 3. Solution of homogeneous Partial differential equations involving derivative with respect to one independent variable only. (C6: Evaluation) 4. Derivation of one dimensional heat and wave equations and their solutions by variable separable method. (C6: Evaluation)
4	1. Explain Double and triple integrals: Evaluation of double and triple integrals. (C2: Comprehension) 2. Evaluation of double integrals by changing the order of integration and by changing into polar co-ordinates. (C6: Evaluation) 3. Application of double and triple integrals to find area and volume. (C3: Application) 4. Describe Beta and Gamma functions: definitions, Relation between beta and gamma functions and simple problems. (C2: Comprehension)

Teaching Learning Strategies and Contact Hours

Learning Strategies	Contact Hours
Lecture	32
Practical	
Seminar/Journal Club	
Small Group Discussion (SGD)	2
Self-Directed Learning (SDL) / Tutorial	14
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	2
Revision	4
Others If any:	
Total Number of Contact Hours	56

Assessment Methods:

Formative	Summative
Periodic Assessment	End Term Examination
Self Directed Learning	
Comprehensive Assessment	
Peer (Group) Activities	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Periodic Assessment	✓	✓	✓	✓
Self Directed Learning	✓	✓	✓	✓
Comprehensive Assessment	✓	✓	✓	✓
Peer (Group) Activities	✓	✓	✓	✓
End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through the Mentor Mentee system. 2. Feedback between the semester through google forms. 3. Course Exit Survey will be taken at the end of the semester.	
References:	Textbooks:

	1. B. S. Grewal "Higher Engineering Mathematics" 44/e, Khanna Publishers, 2017. 2. Erwin Kreyszig "Advanced Engineering Mathematics" 10/e, John Wiley& Sons, 2011.
	References: 1. R.K. Jain and S. R.K. Iyengar "Advanced Engineering Mathematics" 3/e, Alpha Science International Ltd., 2002. 2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas "Calculus" 13/e, Pearson Publishers, 2013

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**SEC-1 (Civil Engineering Drawing Lab)**
Academic Year	II
Semester	III
Number of Credits	2
Course Prerequisite	
Course Synopsis	Introduction to engineering drawing; drafting as a language, drafting environment, board drafting, Computer Aided Drawing and Design. Geometrical Constructions; two- dimensional drawing, sketching for creating solid models, drawing and editing commands in AutoCAD environment, 2D and 3D tools of AutoCAD. Orthographic projection; 1st and 3rd angle projection, Principal views, Basic Dimensioning, size tolerances, Introduction to solid modelling in Autodesk Inventor, creating solid model of structures in Autodesk Inventor environment. Creating orthographic views from a solid model in AutoCAD

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

CO1	Draw two-dimensional sketches, views in CAD environment (particularly in AutoCAD)
CO2	Draw the orthographic views of an object in CAD environment (particularly in Autodesk AutoCAD environment).
CO3	Draw plan and elevation views of a building in AutoCAD environment
CO4	Create solid models of objects; objects in basic shapes, custom built components, building models etc. using the tools of AutoCAD
CO5	Create the solid model of structures in Autodesk Inventor environment

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P01 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	3	3	3	2	3	3	3			
CO2	3	3	3	3	3	3	1	2	2	2	3	3			
CO3	2	3	2	3	3	2		3	2	1	3	2			
CO4	2	3	3	3	3	2	1	2	2	2	3	2			
CO5	2	3	3	3	3	3	2	3	2	2	3	3			
Average	2.3	3	2.8	3	3	2.6	1.1	2.6	2	2	2.8	2.1			

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	4	4

Experiment No.	Content

1.	Select various CAD commands with simple examples C2 (Understanding)
2.	Draw Line diagrams of different structures (C1, C6)
3.	Isometric exercises C3 (Application)
4.	Draw Orthographic projection C6 (Create)
5.	Design and draw Doors and Windows in any building C6 (Create)
6.	Calculation of area of closed traverse C4 (Analysis)
7.	Create Plan, section and elevation of residential building C6 (Create)
8.	Create Plan, section and elevation of public building C6 (Create)
9.	Create Plan, section and elevation of multistoried building C6 (Create)
10.	Preparation of Site plan of a Residential building C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	26
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	14
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	**Summative**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓	✓

<table>
<tr><td colspan="2"></td></tr>
<tr><td>Feedback Process</td><td>1. Student’s Feedback</td></tr>
<tr><td colspan="2">Students Feedback is taken through various steps
1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms</td></tr>
</table>

Course for Specialization

- **Structural Engineering**
- **Green Technology and Sustainable Engineering**
- **Construction Technology**

Sustainable Building Materials and Construction Techniques	3	0	0	3
Sustainable Building Materials and Construction Techniques Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Sustainable Building Materials and Construction Techniques**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	Nil
Course Synopsis	This course introduces the fundamentals of sustainability in the built environment, focusing on environmental impacts and assessment tools. It covers renewable, recycled, and low-impact materials along with eco-friendly construction techniques. Passive design strategies and resource-efficient systems for energy and water management are emphasized. Students will explore, evaluate, and develop integrated sustainable building solutions using modern and traditional approaches.

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

CO1	Identify and explain the principles of sustainability, environmental impacts of construction, and green rating systems.
CO2	Analyze and compare sustainable materials and eco-friendly construction techniques based on environmental, economic, and functional criteria.
CO3	Apply passive design strategies, renewable energy systems, and water conservation techniques in sustainable building design.
CO4	Evaluate the performance of sustainable solutions and develop integrated, site-specific resource-efficient construction strategies using smart tools.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-

CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	**Content**	**Competencies**
1	Introduction to sustainability principles and environmental impact of construction — C1 (Remember). Understanding Life Cycle Assessment and green building rating systems — C2 (Understanding). Application of LCA and certification frameworks in real projects — C3 (Application). Analysis of rating systems and SDG alignment — C4 (Analysis). Evaluation of sustainability strategies in case studies — C5 (Evaluate). Creation of sustainability action plans for building projects — C6 (Create).	
2	Identification of renewable and recycled materials — C1 (Remember). Understanding properties of earth-based and industrial by-product materials — C2 (Understanding). Application of sustainable materials in construction — C3 (Application). Analysis of materials based on durability, cost, and embodied energy — C4 (Analysis). Evaluation of materials through case comparisons — C5 (Evaluate). Creation of context-based hybrid material proposals — C6 (Create).	
3	Introduction to modular, prefabricated, and vernacular techniques — C1 (Remember). Understanding traditional and passive construction systems — C2 (Understanding). Application of passive design features in building plans — C3 (Application). Analysis of building envelopes for energy efficiency — C4 (Analysis). Evaluation of construction methods for sustainability and cost — C5 (Evaluate). Creation of envelope designs responsive to climate and site — C6 (Create).	
4	Listing of water conservation and renewable energy systems — C1 (Remember). Understanding smart technologies and system integration — C2 (Understanding). Application of water and energy systems in building layouts — C3 (Application). Analysis of performance metrics and environmental impact — C4 (Analysis). Evaluation of integrated systems using case examples — C5 (Evaluate). Creation of a sustainable building resource strategy using BIM — C6 (Create).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	21
Practical	--
Seminar/Journal Club	04
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4		
Peer Group activities	✓	✓	✓	✓		
Quiz	✓	✓	✓	✓		
Seminars	✓	✓	✓	✓		
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓		
Comprehensive assessment	✓	✓	✓	✓		
University End Term Examination	✓	✓	✓	✓		

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	1. Jagadish K.S. – Alternative Building Materials and Technologies, New Age International Publishers 2. Edward Allen & Joseph Iano – Fundamentals of Building Construction: Materials and Methods, Wiley

	3. Mehta, P.K. & Monteiro, P.J.M. – Concrete: Microstructure, Properties, and Materials, McGraw-Hill 4. Ashok L. Kumar & K. Ilangovan – Green Building: Principles and Practices in Residential Construction, Cengage Learning

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103122
Course Title	**Sustainable Building Materials and Construction Techniques Lab**
Academic Year	II
Semester	III
Number of Credits	1
Course Prerequisite	Nil
Course Synopsis	This lab course provides practical exposure to sustainable building materials, construction techniques, and energy-efficient systems. Students will engage in experiments focused on eco-friendly materials, resource-saving technologies, and the performance of various building systems. Hands-on experience with testing and evaluating materials like bamboo, recycled concrete, and thermal insulation will deepen their understanding of sustainable construction. The course aims to bridge theory with practice in the design and implementation of green building solutions.

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

CO1	Demonstrate the ability to test and evaluate sustainable building materials for strength, durability, and environmental performance.
CO2	Apply experimental techniques to analyze the efficiency of eco-friendly construction methods and energy-saving systems.
CO3	Evaluate and compare the effectiveness of different resource-efficient systems, such as solar panels, rainwater harvesting, and greywater recycling.
CO4	Develop and propose practical solutions for integrating sustainable building materials and techniques into real-world construction projects.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-

Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	**0**	**2**	**2**

Experiment No.	Content
1.	Testing the Properties of Bamboo as a Construction Material
2.	Comparison of Natural and Industrial Waste-Based Concrete
3.	Soil Stabilization Techniques for Sustainable Construction
4.	Testing the Thermal Conductivity of Various Building Materials
5.	Performance Evaluation of Green Roof Systems
6.	Rainwater Harvesting and Filtration System Setup
7.	Energy Efficiency in Building Envelopes
8.	Testing of Solar Panel Efficiency in Different Orientations
9.	Greywater Recycling System Design and Evaluation
10.	Evaluating the Effectiveness of Insulating Materials

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	

Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

SEMESTER - IV

Course Code	Course Title
130104111	Structural Analysis
130104112	Fluid Mechanics
130104113	Fluid Mechanics Lab
130104114	Concrete Technology
130104115	Concrete Technology Lab
	Geomatics Engineering
	Geomatics Engineering Lab
	Engineering Chemistry
	SEC-II (GIS Lab)
	Ability Enhancement Course (AEC)-IV
	Constitution of India (MCNC)
Additional Credits for Specialization Structural Engineering	
	Structural Analysis by Matrix Methods
	Structural Analysis by Matrix Methods Lab
Additional Credits for Specialization Green Technology and Sustainable Engineering	
	Green Building Design and Certification Systems
	Green Building Design and Certification Systems Lab
Additional Credits for Specialization Construction Technology	
	Construction Quality Control and Safety Management
	Construction Quality Control and Safety Management Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104111
Course Title	**Structural Analysis**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures

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

CO1	Identify the method of analysis for determinate structures
CO2	Understand the importance of various methods of slope and deflections for determinate structures.
CO3	Use the influence line diagram.
CO4	Understand the methods of analysis for indeterminate structures.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	1		3	2	1	3		3	1	2
CO2	3	3	2	2	1	1		3	2	1	3		3	1	2
CO3	3	3	2	2	1	1		3	2	1	3		3	1	2
CO4	3	3	2	2	1	1		3	2	1	3		3	1	2
Average	3	3	2	2	1	1		3	2	1	3		3	1	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	**Content**

1	Basic understanding of the strain energy method and its application in analyzing indeterminate structures (C1, C3, C4), Classify beam and joints C2 (Understanding); difference between pin jointed and rigid jointed structures C4 (Analysis), analysis of beam against temperature effect C4 (Analysis)
2	Define static determinacy and indeterminacy of Structures C1 (Remember), Explain the Theorem of Three Moments C2 (Understanding), Analyze beams and frames using the slope deflection method and moment distribution method (C4 and C6)
3	Basic understanding of the concepts and terminologies related to arches, cables, influence lines, strain energy, Castigliano's theorem and unit load method (C1 and C2), identify different types of arches such as circular arch, two hinged and three hinged parabolic arches C2 (Understanding); analysis of arches, cables, and influence lines (C4, C6) analyze the horizontal thrust and bending moments in arches by using influence lines diagram C4 (Analysis); understanding of Castigliano's theorem and its applications for the calculation of deflections in statically determinate beams and trusses (C2, C3, C4)
4	Basic understanding of influence lines and their significance in structural analysis, analysis of beam for load position, shear force and bending moment using influence line diagram (C4, C5), State and application for the analysis of beam using Muller Breslau's principle, Maxwell's reciprocal theorem, Maxwell Betti's theorem (C1, C2, C4)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	21
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	4
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	
References:	
	Text Books 1. R.C. Hibbler , Structural Analysis (2011) , Pearson Education. 2. S. Ramamrutham, Theory of Structures, Dhanpatrai Publishers **Reference Books** 1. Jain,O.P.and Jain, B.K., "Theory &Analysis of Structures". Vol.I& II Nem Chand brothers. 2. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill 3. Chukia Wang 4.Coates,R.C.,Coutie,M.G. & Kong, F.K., "Structural Analysis", English Language BookSociety& Nelson.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Fluid Mechanics**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Fluid mechanics includes fluid statics and dynamics, conservation of mass, momentum, and energy in incompressible flow & flow of a real fluid--including laminar and turbulent flow, dimensional analysis and similitude & the applications to engineering problems.

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

CO1	Calculate static and dynamic forces on hydraulic structures.
CO2	Determine pressure in a closed conduit carrying fluids.
CO3	Determine unknown factors with the help of dimensional analysis.
CO4	Calculate the drag forces on a body in a flowing fluid as well as drag forces on a moving body in the fluid with the concept of boundary layer theory.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1			2		2		3	1	1
CO2	3	3	3	3	3	1			2		2		3	1	1
CO3	3	3	3	3	3	1			2		2		3	1	1
CO4	3	3	3	3	3	1			2		2		3	1	1
Average	3	3	3	3	3	1			2		2		3	1	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content
1	Basic understanding of fundamental properties such as density, viscosity, surface tension, compressibility, capillarity, vapor pressure, cavitation; and concept of fluid i.e. hydrostatic forces, buoyancy. metacentric stability (C1, C2); analyze buoyancy and its relationship to the center of buoyancy and metacentric stability C4 (Analysis); understanding of fluid pressure at a point and Pascal's law and their practical applications (C3, C4); pressure measurements using manometers and piezometers C5 (Evaluate); determine the hydrostatic forces on plane, inclined and curved surfaces submerged in

	a fluid C5 (Evaluate); analysis of stability and equilibrium for floating and submerged bodies C4 (Analysis), measurement of Pressure at a point in incompressible fluid C5 (Evaluate)
2	Basic understanding of fluid flow and fluid kinematics C1 (Remember), classify the different types of flow including steady, unsteady, uniform, non-uniform, rotational, irrotational, and 1-D, 2-D, and 3-D flows C2 (Understanding); Derive Euler and Bernoulli's equations and their applications, C3 (Application); Impulse Momentum equation, Navier-Stokes-Equations and its applications, analysis of fluid properties using Impulse Momentum equation, Navier-Stokes-Equations (C4, C5); Application of moment equation, momentum and energy correction factors in the analysis of fluid characteristics (C3, C4)
3	basic understanding of flow through orifices, mouthpieces, notches, weirs, pipes and losses in pipes including the laws of fluid friction, Darcy's equation, Chezy's formula, Manning's formula, Hazen-William's formula (C1, C2); concept of discharge measurement using devices such as venturimeters, orifice meters, pitot tubes, pipe network, major and minor losses (C2, C3); differentiate between Flow through pipes in terms of Laminar, Transition and Turbulent flow C4 (Analysis); analyze the discharge measurement using venturimeters, orifice meters, and pitot tubes (C4, C5); Derive and Application of different law i.e. laws of fluid friction and equation such as Darcy's equation, Chezy's formula, Manning's formula, Hazen-William's formula for the analysis of discharge or flow (C3, C4)
4	Concept of boundary layers and their characteristics i.e. Boundary layer thickness, displacement & momentum thickness, boundary layer separation, Dimensional homogeneity, Similitude C2 (Understanding); differentiation between laminar and turbulent flow C4 (Analysis); design and operation of hydraulic machines, including centrifugal and reciprocating pumps, and turbines C6 (Create); Derivation/Formulation of Raleigh and Buckingham π theorems, Model laws; distorted and undistorted models C6 (Create); Compare the types of similarities C4 (Analysis); differentiate the various types of forces acting on moving fluid and dimension less numbers C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	--
Revision	4
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Text Books 1. R.K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines (2011), ISBN No. 978-81-318-0815-3 9th Publications, Laxmi Publication. **Reference Books** 1. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, Katson Publishing House. 2. V.L. Streeter, Fluid Mechanics, McGraw Hill Book Co. 3. K. Subramanian, Fluid Mechanics and hydraulic machines McGraw Hill Book Co. 4. P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Fluid Mechanics Lab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	
Course Synopsis	Fluid mechanics includes fluid statics and dynamics, conservation of mass, momentum, and energy in incompressible flow & flow of a real fluid--including laminar and turbulent flow, dimensional analysis and similitude & the applications to engineering problems.

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

CO1	Calculate static and dynamic forces on hydraulic structures.
CO2	Determine pressure in a closed conduit carrying fluids.
CO3	Determine unknown factors with the help of dimensional analysis.
CO4	To calculate the drag forces on a body in a flowing fluid as well as drag forces on a moving body in the fluid with the concept of boundary layer theory.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3		3	3	2			2		2	3	3	1	1
CO2	3	3		3	3	2			2		2	3	3	1	1
CO3	3	3		3	3	2			2		2	3	3	1	1
CO4	3	3		3	3	2			2		2	3	3	1	1
Average	3	3		3	3	2			2		2	3	3	1	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	2	2

Experiment No.	Content
1.	Conducting experiments to verify Bernoulli’s theorem C4 (Analysis)
2.	Determination of the Coefficient of discharge of given Venturi-meter C5 (Evaluate)
3.	Determination of the Coefficient of discharge of given rectangular notch C5 (Evaluate)
4.	Determination of the Coefficient of discharge of given V- notch C5 (Evaluate)
5.	Determination of head loss in pipes connected in series C5 (Evaluate)

6.	Examine the performance characteristics of reciprocating pump C4 (Analysis)
7.	Examine the performance characteristics of Centrifugal pump C4 (Analysis)
8.	Determination of head loss in pipes connected in parallel C5 (Evaluate)
9.	Determine frictional losses in piping systems C5 (Evaluate)
10.	To measure the fluid flow rate in pipes using venturi meter C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	18
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	8
Problem Based Learning (PBL)	4
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104114
Course Title	**Concrete Technology**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Concrete is one of the most vital materials used in construction. Concrete is made up of cement, coarse aggregate; fine aggregate, water and admixtures. The strength of concrete is directly depending upon the properties of these materials and their proportion in the concrete. In this course students will learn the various properties of concrete ingredients and various properties of concrete itself and their testing including non-destructive testing such as ultrasonic pulse velocity test, rebound hammer test etc. They will also learn the various mix design methods to design the concrete for different construction works.

Course Outcomes:

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

CO1	To identify suitable materials to be used in the cement concrete by conducting various tests as per BIS code.
CO2	Test all the concrete materials as per BIS code.
CO3	Design the concrete mix using ACI and BIS code methods.
CO4	Determine the properties of fresh and hardened of concrete.
CO5	Design special concretes and their specific applications and use of admixtures.
CO6	Ensure quality control while testing/ sampling and acceptance criteria for pre and post construction work.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	2	1
CO2	3	3	3	3	3	3	1	2	2	2	3	3	3	2	2
CO3	2	3	2	3	3	2		3	2	1	3	2	3	2	2
CO4	2	3	3	3	3	2	1	2	2	2	3	2	3	2	2
CO5	2	3	3	3	3	3	2	3	2	2	3	3	3	2	1
CO6	2	3	3	3	3	3	1	3	2	2	2	1	3	2	2
Average	2.3	3	2.8	3	3	2.6	1.1	2.6	2	2	2.8	2.1	3	2	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Basic concept of concrete its raw materials such as cement, aggregates and water and its manufacturing methods (C1, C2); Classify the raw materials such as cement, aggregates into different categories C2 (Understanding); Application of raw materials in the production of concrete C3 (Application); tests on cement, aggregates, water etc. C4 (Analysis); Analysis of Bogue's compound and hydration of cement C4 (Analysis)	
2	Basic concept of admixtures in the concrete (C2, C2), describe the different types of admixtures and their application (C2, C3); Operation of different phases of concrete i.e. batching, Mixing, Transportation, placing of concrete, curing of Concrete (C3; C4)	
3	Concept and understanding of fresh and hardened properties of concrete and microcracking of concrete (C1, C2); application and examination on the workability, strength and durability properties (creep, shrinkage, permeability, corrosion, carbonation, chemical attack, temperature/thermal effect) (C3, C4, C5), Operation of concreting under different environmental conditions (C3, C4)	
4	Basic understanding of mix proportions and quality control (C1, C2); concrete mix design by IS provisions (C6) by ACI method and I.S. code method C6 (Create); Application and devolvement of special types of concrete i.e., Light-weight concrete, Fiber reinforced concrete, Polymer modified concrete, Ferro cement, Mass concrete, Ready-mix concrete, Self-compacting concrete (C3, C4, C6)	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	21
Practical	--
Seminar/Journal Club	04
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Peer Group activities	✓	✓	✓	✓	✓	✓
Quiz	✓	✓	✓	✓	✓	✓
Seminars	✓	✓	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	
References:	
	Text Books 1. Gambhir, M.L., Concrete Technology (2012) ISBN No. 978-00-07-015133, 9th Edition, Tata McGraw Hill. 2. Mehta and Montiero, Properties of Concrete, Pearson. **Reference books:-** 1. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co. 2. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi. 3. Nevile, Properties of Concrete, Longman Publishers.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104115
Course Title	**Concrete Technology Lab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Concrete is one of the most vital materials used in construction. Concrete is made up of cement, coarse aggregate; fine aggregate, water and admixtures. The strength of concrete is directly depending upon the properties of these materials and their proportion in the concrete. In this course students will learn the various properties of concrete ingredients and various properties of concrete itself and their testing including non-destructive testing such as ultrasonic pulse velocity test, rebound hammer test etc. They will also learn the various mix design methods to design the concrete for different construction works.

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

CO1	To identify suitable materials to be used in the cement concrete by conducting various tests as per BIS code.
CO2	Test all the concrete materials as per BIS code.
CO3	Design the concrete mix using ACI and BIS code methods.
CO4	Determine the properties of fresh and hardened of concrete.
CO5	Design special concretes and their specific applications and use of admixtures.
CO6	Use of non-destructive testing equipment

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	2	1
CO2	3	3	3	3	3	3	1	2	2	2	3	3	3	2	2
CO3	2	3	2	3	3	2		3	2	1	3	2	3	2	2
CO4	2	3	3	3	3	2	1	2	2	2	3	2	3	2	2
CO5	2	3	3	3	3	3	2	3	2	2	3	3	3	2	1
Average	2.3	3	2.8	3	3	2.6	1.1	2.6	2	2	2.8	2.1	3	2	2

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**

0	0	2	2

Experiment No.	Content
1.	Compressive Strength test of Cement Cube C4 (Analysis)
2.	Determine the specific gravity of fine sand (C4, C5)
3.	Determine Flakiness, elongation and hardness of coarse aggregates (C4, C5)
4.	Determine soundness of cement (C4, C5)
5.	Workability by Compaction Factor, Slump Test (C4, C5)
6.	Determination of Constituents of Hardened Mortar (C4, C5)
7.	Mix Design by IS Code Method (C4, C5, C6)
8.	Compressive strength of Concrete cube (C4, C5)
9.	Compressive strength of Concrete cylinder (C4, C5)
10.	Compressive strength of Concrete Using NDT (C4, C5)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓	✓

<table>
<tr><td>Feedback Process</td><td>1. Student’s Feedback</td></tr>
<tr><td colspan="2">Students Feedback is taken through various steps
1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms</td></tr>
</table>

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Geomatics Engineering**
Academic Year	II
Semester	IV
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

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

CO1	Understand the principles of land surveying and the significance of surveying concepts and techniques.
CO2	Describe the different methods of land measurements and perform basic survey calculations.
CO3	Analyze and interpret survey data from the instruments and measurements.
CO4	Apply surveying methodologies to real-world projects and communicate the results effectively.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	2	1	3	-	3
CO2	3	3	3	3	2	-	-	-	-	-	2	1	3	-	3
CO3	3	3	3	3	2	-	-	-	-	-		1	3	-	2
CO4	3	3	3	3	2	-	-	-	-	-		1	3	-	3
Average	3	3	3	3	2	-	-	-	-	-	1.2	1	3	-	2.75

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
2	**0**	**0**	**2**

Unit	Content	

1	Define plane surveying C1 (Remember), Describe the conventional tape measurements and electronic distance measurement C2 (Understanding), Explain the compass surveying, Fore and Back bearing, true and magnetic bearing, magnetic dip and declination, local attraction. Examine the numerical problem on bearing C4 (Analysis).
2	Use of Dumpy level, Tilting level and Auto level C3 (Application). Describe the Temporary and Permanent adjustment of Dumpy level C2 (Understanding). Compare the differential leveling, Longitudinal & Cross sectional leveling, refraction & curvature correction, Reciprocal leveling C4 (Analysis) Describe the contouring and characteristics of contours, contour gradient, C2 (Understanding), plotting and use of contours C3 (Application).
3	Describe and compare the theodolites– Temporary and Permanent adjustments (C2 and C4), Formulate the horizontal and vertical angle measurements C6 (Create), measurement of magnetic bearing. Describe the electronic total station- Introduction and determination (C2 and C6). Classify the different system of tachometric measurement C2 (Understanding), Use of Principle of stadia method C3 (Application), Formulate the distance and elevation for staff in different position (Normal, Vertical, Inclined) C6 (Create)
4	Compare the different methods of plane table surveying C2 (Understanding), Investigate the two- and three-point problems as well as mechanical and graphical method for orientation of plane table C6 (Create). Investigate the adjustment of closed traverse C6 (Create). Describe the principles of geodetic surveying and corrections C2 (Understanding), Use of GPS & GIS in surveying C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	18
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	8
Problem Based Learning (PBL)	4
Case/Project Based Learning (CBL)	–
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. **Feedback between the semester through google forms**

References:

Text Books

1. Punmia B.C, Surveying (2011), Volume 1, 2, 3 Sixteenth edition, ISBN No. 81-7008-853-4, Laxmi Publications.

Reference books

1. Subramanian R, Surveying and Levelling, Publication Oxford University Press.
2. Kanetkar T.P, Surveying and Levelling, Vol I, Pune.
3. Kanetkar T.P, Surveying and Levelling, Vol II, Pune.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Geomatics Engineering Lab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

Course Outcomes: At the end of the course students will be able to:	
CO1	Understand and apply the basic principles of surveying techniques.
CO2	Differentiate and select the appropriate surveying equipment for particular surveys.
CO3	Conduct a survey by using various surveying instruments.
CO4	Analyze and synthesis field notes into a final survey report.
CO5	Prepare a topographic map of a given area with the help of the data collected in the field.
Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:	

COs	**P O1**	**P O2**	**P O3**	**P O4**	**P O5**	**P O6**	**P O7**	**P O8**	**P O9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	**3**	**3**	**3**	**3**	**2**						**2**	**1**	3	-	3
CO2	**3**	**3**	**3**	**3**	**2**						**2**	**1**	3	-	3
CO3	**3**	**3**	**3**	**3**	**2**							**1**	3	-	2
CO4	**3**	**3**	**3**	**3**	**2**							**1**	3	-	3
CO5	**3**	**3**	**3**	**3**	**2**						**2**	**1**	3	-	2
Avera ge	**3**	**3**	**3**	**3**	**2**						**1.2**	**1**	3	-	2.6

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**2**	**2**
Experiment No.	**Content**		

1.	Demonstrate the measurement of distance using tape/Chain C3 (Application)
2.	Application of Compass Survey-Traversing using Compass C3 (Application)
3.	Investigate the horizontal angles by method of repetition and reiteration using Theodolite C6 (Create)
4.	Demonstrate the Two-point problem using Plane Table Survey-(Lehman's method) C3 (Application)
5.	Demonstrate the Three-point problem using Plane Table Survey-(Lehman's method) C3 (Application)
6.	Levelling- Rise & Fall method C4 (Analysis)
7.	Levelling- Height of collimation method C4 (Analysis)
8.	Tacheometric survey- Determination of horizontal distance C5 (Evaluate)
9.	Tacheometric survey- Determination of RL C5 (Evaluate)
10.	Determine the contours for a given location C4 (Analysis)
11.	Determine the angle and distance using theodolite C3 (Application)
12.	Determine the angle and distance using theodolite C3 (Application)
13.	Determine the angle and distance using total station C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	18
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	8
Problem Based Learning (PBL)	4
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	**Summative**
Practical/Lab/ClinicalProficiency (Laboratory/WorkshopPerformance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**

Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Engineering Chemistry**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course explores the chemistry of cement and clinker, covering manufacturing, hydration mechanisms, admixtures, microstructure, and durability. It also examines sustainability, green technologies, and advanced materials like geopolymers and self-healing cements, equipping students with a comprehensive understanding of cementitious systems for innovative and durable construction applications.

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

CO1	To develop a fundamental understanding of atomic structure, chemical bonding, and molecular interactions in engineering materials.
CO2	To explore the chemical principles behind corrosion, electrochemistry, water treatment, and sustainable practices.
CO3	To study the synthesis, characterization, and applications of polymers, composites, nanomaterials, and smart materials.
CO4	To enable the application of analytical techniques and green chemistry concepts in solving real-world engineering problems.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1			2		2		3	1	1
CO2	3	3	3	3	3	1			2		2		3	1	1
CO3	3	3	3	3	3	1			2		2		3	1	1
CO4	3	3	3	3	3	1			2		2		3	1	1
CO5	3	3	3	3	3	1			2		2		3	1	1
Average	3	3	3	3	3	1			2		2		3	1	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content
1	Definition of matter and its classification: elements, compounds, and mixtures, Physical and chemical properties of matter. Structure of an atom,

	Atomic Number, Molecular Mass, Isotopes, Ions, Concept of a mole, Avogadro's number, Periodic Table. Overview: Groups, Periods, Metals, Non-metals, Metalloids. Bond properties: Bond length, Bond Strength, Polarity. Molecular Interactions: Van der Waals forces, Dipole-Dipole interactions, Hydrogen bonding.
2	History and types of cement (Ordinary Portland Cement, Blended Cements), Raw materials and manufacture of Portland cement, Phase composition of clinker (C_3S, C_2S, C_3A, C_4AF), Cement standards and classification (ASTM, EN, IS), Basic chemistry and mineralogy of raw materials Corrosion: Types (Dry and Wet), Electrochemical Theory, Carbonation-induced corrosion, Chloride induced Corrosion, Protection Methods (anodic/cathodic protection, inhibitors, coatings).
3	Water hardness: Types, Determination by EDTA method, Industrial Water Treatment: RO, Ion Exchange, Nanofiltration, Membrane technologies, Green Chemistry Principles: Atom economy, green solvents, renewable feedstocks, Environmental pollution: Chemical causes and mitigation via green technology.
4	Classification: Thermoplastics, Thermosetting, Elastomers, Engineering Polymers: Nylon, Kevlar, Teflon, PMMA, Bakelite, Polymer composites: Fiber-reinforced plastics (FRP), Carbon Fibre, GFRP, Aramid-based materials, Shape Memory Alloys (SMA), Piezoelectric materials, Magneto-rheological fluids.

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	--
Revision	4
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

References:	
	Text Books **H.F.W. Taylor**, *Cement Chemistry* (1997), ISBN No. 978-0727725929, 2nd Edition, Thomas Telford Publishing **Peter Hewlett (Editor)**, *Lea's Chemistry of Cement and Concrete* (2004), ISBN No. 978-0750662567, 4th Edition, Butterworth-Heinemann **P.K. Mehta and Paulo J.M. Monteiro**, *Concrete: Microstructure, Properties, and Materials* (2014), ISBN No. 978-0071797870, 4th Edition, McGraw-Hill Education S.K. Garg, Water Supply upply Engineering

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**GIS Lab**
Academic Year	II
Semester	IV
Number of Credits	2
Course Prerequisite	
Course Synopsis	GIS technology for spatial design/analysis; applications in facilities management, urban infrastructure, water resources, environmental and transport engineering

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

CO1	Understand comprehensive instruction in the underlying concepts and principles of geographic information system (GIS) technology
CO2	Apply GIS to the design and analysis of Water Resources Engineering & Transportation Engineering systems
CO3	Understand spatial data acquisition, geoprocessing, geostatistical methods
CO4	Visualize, and querying of spatial data; network modeling, terrain mapping, and spatial analysis
CO5	Become proficient in usage of QGIS software through extensive computer lab sessions, including applications in transportation network analysis, and river basin management

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	2	2	2	2	3	3	3	1	2	1	2	3	3	3	2
CO2	3	2	2	2	3	3	3	2	2	2	2	3	3	3	2
CO3	3	2	2	2	3	2	2	1	2	1	2	2	3	3	2
CO4	3	2	2	2	3	2	2	2	2	2	2	2	3	3	2
CO5	3	3	3	3	3	3	3	1	2	1	2	3	3	3	2
Average	2.8	2.2	2.2	2.2	3	2.6	2.6	1.4	2	1.4	2	2.6	3	3	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	4	4

Experiment No.	Content
1.	Familiarization with GIS Software, Data Input
2.	Geo Referencing and Projections
3.	Digitization of Map / Toposheet
4.	Creation of Thematic Maps
5.	Base Map Preparation

6.	Data Conversion – Vector to Raster, Raster to Vector
7.	Adding Attribute Data – Querying On Attribute Data
8.	Vector Analysis
9.	Raster Analysis
10.	Map Composition
11.	Developing Digital Elevation Model
12.	Simple Applications of GIS in Water Resources Engineering & Transportation Engineering

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	26
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	14
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	**Summative**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓	✓

Feedback Process	1. Student’s Feedback
Students Feedback is taken through various steps	

1. Regular feedback through Mentor Mentee system
2. **Feedback between the semester through google forms**

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	Constitution of India
Academic Year	II
Semester	IV
Number of Credits	NIL
Course Prerequisite	NIL
Course Synopsis	The course on Constitution of India is designed to make students aware of the fundamental tenets of the Indian Constitution, the structure and functions of the government, and the rights and responsibilities of citizens. It aims to instill civic sense, constitutional values, and awareness of democratic processes among engineering graduates, enabling them to act as responsible professionals and citizens.

Course Outcomes:

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

CO1	Understand the historical background, features, and structure of the Indian Constitution.
CO2	Interpret the Fundamental Rights and Duties, and Directive Principles of State Policy.
CO3	Explain the roles and responsibilities of the Union, State, and Local Governments.
CO4	Evaluate the significance of the Constitution in protecting individual liberty, national integrity, and promoting good governance.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)& Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	3	3	-	-	2	2	-	-	-
CO2	3	-	-	-	-	3	3	3	-	-	2	2	-	-	-
CO3	3	-	-	-	-	2	3	3	1	1	2	2	-	-	-
CO4	3	-	-	-	-	3	3	3	1	1	2	2	-	-	-
Average	3	0	0	0	0	2.5	3	3	0.5	0.5	2	2	0	0	0

<table>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>L (Hours/Week)</td><td>T (Hours/Week)</td><td>P (Hours/Week)</td><td>Total Hour/Week</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Unit</td><td colspan="3">Content & Competencies</td></tr>
<tr><td>1</td><td colspan="3">Introduction to the Constitution (C2)
• Historical background and making of the Indian Constitution
• Salient features and sources
• Preamble and its importance
• Union and its Territory
• Citizenship</td></tr>
<tr><td>2</td><td colspan="3">Rights and Duties of Citizens (C2–C3)
• Fundamental Rights and their scope
• Fundamental Duties
• Directive Principles of State Policy and their relevance
• Constitutional remedies and writs under Article 32</td></tr>
<tr><td>3</td><td colspan="3">Union and State Government Structure (C2–C3)
• President, Prime Minister, Council of Ministers
• Parliament: Lok Sabha and Rajya Sabha
• State Executive: Governor, Chief Minister, State Legislature
• Judiciary: Structure, powers, and independence</td></tr>
<tr><td>4</td><td colspan="3">Local Governance, Amendments, and Values (C2–C4)
• Panchayati Raj and Municipalities – 73rd and 74th Amendments
• Election Commission and Electoral Reforms
• Amendment Procedure (Article 368)
• Constitution as a living document – relevance to engineers and professionals
• Case studies on equality, justice, and governance</td></tr>
</table>

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	2
Small Group Discussion (SGD)	2
Self-Directed Learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	

Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2 (Mid Term 3 is optional)
Assignments	University End Term Examination
Student Seminar	Project
Problem Based Learning (PBL)	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Assignment / Presentation	✓	✓	✓	✓
Mid Semester Examination 1	✓	✓	✓	✓
Mid Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓
Feedback Process	1. Student's Feedback 2. Course Exit Survey			
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system. 2. Feedback between the semester through google forms. 3. Course Exit Survey will be taken at the end of semester.				

References:	(List of reference books)
	i) M. Laxmikanth, *Indian Polity*, 7th Edition, McGraw Hill Education, 2023, **ISBN**: 9789355322409 **ii)** D.D. Basu, *Introduction to the Constitution of India*, 25th Edition, LexisNexis, 2021, **ISBN**: 9789389991224

	iii) Subhash Kashyap, *Our Constitution: An Introduction to India's Constitution and Constitutional Law*, 3rd Edition, National Book Trust, 2020, **ISBN**: 9788123763841

Course for Specialization

Structural Engineering

Structural Analysis by Matrix Methods	3	0	0	3
Structural Analysis by Matrix Methods Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Structural Analysis by Matrix Methods**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course introduces students to matrix-based techniques for structural analysis of trusses, beams, and frames It focuses on the development and application of stiffness and flexibility matrices. Students learn to analyze determinate and indeterminate structures using the direct stiffness method. The course includes basic exposure to structural analysis software and computational modeling.

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

CO1	Apply matrix algebra to formulate structural equilibrium equations for simple structures.
CO2	Develop and transform element stiffness matrices for trusses and beams in global coordinates.
CO3	Analyze indeterminate structures using the direct stiffness method and interpret structural behavior.
CO4	Evaluate the flexibility method and implement matrix-based solutions using software tools.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies
1	Introduction to matrix operations (addition, multiplication, transpose, inverse) and application to solving linear simultaneous equations. C1 (Remember), C2 (Understanding), C3 (Application). Matrix representation of structural systems using force-displacement relationships for axial members. C1 (Remember), C2 (Understanding), C3 (Application).	
2	Development of element stiffness matrices for truss and beam elements in local coordinates. C1 (Remember), C2 (Understanding), C3 (Application). Transformation of stiffness matrices to global coordinates. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis). Assembly of global stiffness matrix and application of boundary conditions. C1 (Remember), C2 (Understanding), C3 (Application).	
3	Application of direct stiffness method to analyze pin-jointed trusses and continuous beams. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis). Handling of support conditions, external loads, and solving for unknown displacements and member forces. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis), C5 (Evaluate).	
4	Overview of the flexibility matrix method for simple statically indeterminate systems. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis). Comparison of flexibility and stiffness methods. C1 (Remember), C2 (Understanding), C5 (Evaluate). Basic introduction to matrix method implementation using structural analysis software. C1 (Remember), C2 (Understanding), C3 (Application), C6 (Create).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

References:	
	Text Books 1. Pandit, G. S., & Gupta, S. P. – Structural Analysis – A Matrix Approach, Tata McGraw-Hill. 2. Weaver, W., & Gere, J. M. – Matrix Analysis of Framed Structures, CBS Publishers. 3. Himanshu Pandey – Structural Analysis: Matrix Approach, Katson Publishing House. 4. Norris, C. H., Wilbur, J. B., & Utku, S. – Elementary Structural Analysis, McGraw-Hill Education.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Structural Analysis by Matrix Methods Lab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab course introduces hands-on application of matrix methods for structural analysis. Students perform stiffness matrix formation, transformation, and system assembly for various elements. Practical analysis of trusses, beams, and frames using both manual and software-based methods is included. The lab enhances understanding of structural behavior through simulations and result interpretation.

Course Outcomes:

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

CO1	Develop stiffness and flexibility matrices for basic structural elements using matrix methods.
CO2	Analyze truss, beam, and frame systems by applying the direct stiffness method manually.
CO3	Implement coordinate transformation and boundary condition applications in structural models.
CO4	Use structural analysis software to validate results and simulate real-world structural systems.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Verification of stiffness matrix for a 2D truss element using theoretical and MATLAB results			
2.	Formation and assembly of global stiffness matrix for a 2-bar truss system			
3.	Analysis of a 2D truss using direct stiffness method with boundary conditions			
4.	Determination of nodal displacements and member forces for a 3-bar planar truss			
5.	Analysis of a continuous beam using matrix stiffness method			
6.	Application of coordinate transformation for beam element stiffness matrices			
7.	Comparative analysis of a simple frame using flexibility and stiffness methods			
8.	Modeling and analysis of a truss using structural analysis software (e.g., STAAD.Pro or SAP2000)			
9.	Analysis of a rigid-jointed frame using direct stiffness method			
10.	Validation of software results with manual matrix method analysis for a given structure			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--

Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student’s Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

Course for Specialization

Green Technology and Sustainable Engineering

Green Building Design and Certification Systems	3	0	0	3
Green Building Design and Certification Systems Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Green Building Design and Certification Systems**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	The course provides foundational knowledge on green building principles and sustainable design practices. It covers energy-efficient systems, site planning, material selection, and water conservation techniques. Students explore various national and international green building certification systems. Case studies and emerging trends prepare learners for real-world green building implementation.

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

CO1	Explain the concepts, benefits, and strategies of green building design and sustainability.
CO2	Analyze and apply design solutions involving energy, water, and material efficiency in buildings.
CO3	Compare and evaluate major green building certification systems and their compliance processes.
CO4	Interpret case studies and emerging innovations to propose sustainable building strategies.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	**Content**	**Competencies**
1	Introduction to matrix operations (addition, multiplication, transpose, Definition, need, and benefits of green buildings including energy efficiency, water conservation, and resource optimization. C1 (Remember), C2 (Understanding), C3 (Application). Climate-responsive architecture and passive design strategies such as orientation, shading, and natural ventilation. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis). Role of site planning in sustainable design including vegetation, drainage, and heat island reduction. C1 (Remember), C2 (Understanding), C3 (Application). Basics of life cycle assessment and selection of sustainable materials. C1 (Remember), C2 (Understanding), C3 (Application).	
2	Energy-efficient HVAC systems, lighting systems, and water-efficient plumbing fixtures for reducing operational energy and water use. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis). Integration of renewable energy technologies like solar PV, wind systems, and hybrid systems in buildings. C1 (Remember), C2 (Understanding), C3 (Application). Indoor environmental quality including ventilation, daylighting, acoustics, and non-toxic materials. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis). Solid and liquid waste management techniques within green building contexts. C1 (Remember), C2 (Understanding), C3 (Application).	
3	LEED, GRIHA, IGBC, and BREEAM rating systems—criteria, point allocation, certification levels, and categories such as sustainable sites, energy, water, and materials. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis). Documentation and compliance process including registration, design submission, and post-construction review. C1 (Remember), C2 (Understanding), C3 (Application), C5 (Evaluate). Comparative analysis of rating systems based on building type, location, and performance benchmarks. C1 (Remember), C2 (Understanding), C4 (Analysis), C5 (Evaluate).	
4	Overview of the flexibility matrix method for simple statically indeterminate Case studies of certified green buildings in India and abroad highlighting design strategies, materials used, and rating achievements. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis), C5 (Evaluate). Retrofitting strategies for transforming existing conventional buildings into green buildings. C1 (Remember), C2 (Understanding), C3 (Application), C5 (Evaluate). Introduction to carbon-neutral design, net-zero energy buildings,	

	ESG (Environmental, Social, Governance) integration in buildings. C1 (Remember), C2 (Understanding), C5 (Evaluate). Overview of digital tools and AI-based design simulations for green building innovation. C1 (Remember), C2 (Understanding), C6 (Create).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

References:	
	Text Books 1. Krigsman, L. M. – Green Building and LEED Core Concepts Guide, U.S. Green Building Council (USGBC). 2. Syal, M., & Nadeem, A. – Green Building: Principles and Practices in Residential Construction, Delmar Cengage Learning. 3. Miller, W. D., & Edwards, R. G. – Sustainable Construction: Green Building Design and Delivery, Wiley-Blackwell. 4. Benson, C., & Walker, B. – Introduction to Green Building: Sustainable Design, Construction, and Operation, McGraw-Hill Education.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Green Building Design and Certification Systems Lab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab course provides hands-on experience with green building design principles and sustainability measures. Students will work on simulations to optimize energy use, water management, and material efficiency in buildings. They will also evaluate certification standards such as LEED and GRIHA for building performance. The course aims to equip students with the practical skills to design and assess sustainable buildings.

Course Outcomes:

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

CO1	Apply simulation tools to design energy-efficient HVAC and lighting systems in buildings.
CO2	Evaluate water conservation strategies and optimize plumbing systems for green buildings.
CO3	Analyze and apply passive design strategies and renewable energy integration for buildings.
CO4	Assess green building certification criteria and measure building performance for sustainability.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Simulation of energy-efficient HVAC systems in a building design model.			
2.	Analysis of daylighting strategies and their impact on energy consumption in buildings.			
3.	Determining the water efficiency of plumbing fixtures and systems in green buildings.			
4.	Calculation of solar panel energy generation potential for a building based on location.			
5.	Simulation of passive cooling and heating systems for buildings using software tools.			
6.	Assessment of building materials based on life-cycle analysis and environmental impact.			
7.	Study and simulation of rainwater harvesting systems for green buildings.			
8.	Evaluation of indoor air quality (IAQ) using green building standards.			
9.	Evaluation of waste management systems and recycling potential in a green building.			
10.	Simulation of building energy performance using LEED certification requirements.			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

Course for Specialization

Construction Technology

Construction Quality Control and Safety Management	3	0	0	3
Construction Quality Control and Safety Management Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Construction Quality Control and Safety Management**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course focuses on the principles and practices of quality control and safety management in construction. Students will explore quality assurance techniques for materials and workmanship and learn to apply safety protocols on construction sites. The course covers the integration of Total Quality Management (TQM) with safety programs to ensure overall project success. Through practical applications, students will gain skills to improve construction quality and safety while minimizing risks.

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

CO1	Understand and apply quality control techniques and standards to construction projects.
CO2	Conduct material testing and ensure quality assurance through proper inspection and testing methods.
CO3	Implement effective safety management practices and risk analysis on construction sites.
CO4	Integrate Total Quality Management (TQM) principles with safety programs for continuous improvement in construction projects.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-

Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	This unit introduces fundamental concepts of quality control (QC) in construction projects, emphasizing the need for quality assurance to meet client specifications and regulatory requirements. Topics include quality standards, quality planning, and quality control techniques in construction, such as sampling, testing, and inspection of materials. The importance of continuous monitoring and documentation during construction phases is also covered. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis).	
2	Focus is placed on materials testing, quality control procedures for concrete, steel, and other construction materials, and their relevance in maintaining the desired structural integrity. The unit covers field and laboratory testing techniques such as slump test, compression test, and aggregate testing for quality assurance. Workmanship quality is also emphasized, including the role of proper construction practices and their impact on long-term durability. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis), C5 (Evaluate).	
3	This unit introduces the principles of safety management and risk assessment on construction sites. Topics include hazard identification, risk analysis, and the application of safety regulations such as OSHA standards. The importance of personal protective equipment (PPE), workplace safety protocols, and accident investigation is also discussed. Key focus is given to implementing safety programs to minimize on-site accidents and injuries, ensuring compliance with safety laws and standards. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis), C5 (Evaluate).	
4	This unit explores the concept of Total Quality Management (TQM) in construction and its application to both quality control and safety management. Students will learn about the role of leadership in implementing safety and quality practices, as well as techniques for continuous improvement through feedback, audits, and reviews. The importance of employee training, communication, and employee participation in maintaining both quality and safety standards is also addressed. C1 (Remember), C2 (Understanding), C3 (Application), C4 (Analysis), C5 (Evaluate), C6 (Create).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	

	Text Books 1. Juran, J.M. & Gryna, F.M. – Quality Planning and Analysis, McGraw-Hill Education. 2. Kumar, S. – Construction Technology and Management, Standard Publishers Distributors. 3. Goetsch, D.L. – Construction Safety and Health, Pearson Education. 4. Oakland, J.S. – Total Quality Management: Text with Cases, Butterworth-Heinemann.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Construction Quality Control and Safety Management Lab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab equips students with practical skills in preparing quality assurance plans, conducting audits, and performing safety inspections. It emphasizes documentation techniques, risk assessment procedures, and compliance with construction safety norms. Students will simulate real-world scenarios to apply quality and safety management practices effectively. The course fosters a strong understanding of standards-based construction oversight and accident prevention.

Course Outcomes:

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

CO1	Develop and implement quality assurance and quality control procedures relevant to construction sites.
CO2	Identify, assess, and document safety risks using standard tools like HIRA and JSA.
CO3	Apply safety regulations and conduct site safety inspections and audits in compliance with legal norms.
CO4	Analyze real or simulated construction incidents to recommend preventive and corrective measures.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-

Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**2**	**2**

Experiment No.	Content
1.	Preparation and implementation of a Quality Assurance (QA) plan for a construction activity.
2.	Site inspection report preparation for workmanship defects in building components.
3.	Conducting an internal quality audit for a construction process using ISO 9001 format.
4.	Assessment of compliance using a sample checklist based on BIS codes and standards.
5.	Evaluation of safety signage and placement on a construction site layout.
6.	Hazard identification and risk assessment (HIRA) for a specific construction operation.
7.	Preparation of a Job Safety Analysis (JSA) sheet for a high-risk construction activity.
8.	Demonstration of emergency response procedures (mock fire drill or accident response).
9.	Inspection and rating of scaffolding and ladder systems as per safety standards.
10.	Root cause analysis of a real or simulated construction accident case study.

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8

Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

SEMESTER - V

Course Code	Course Title
130105111	Reinforced Concrete Structures
	Environmental Engineering
	Environmental Engineering Lab
	Highway Engineering
	Highway Engineering Lab
	Numerical Methods
130105116	SEC-III (BIM Lab)
130105117	Industrial Training-I / MOOC Course
	Personality Development & Career Building (MCNC)
Program Elective-III Pool (Choose One from the pool)	
	Engineering Geology
	Advance Geomatics Engineering
	Open Channel Flow
	Advanced Structural Analysis
Additional Credits for Specialization Structural Engineering	
	Introduction to Finite Element analysis
	Introduction to Finite Element analysis Lab
Additional Credits for Specialization Green Technology and Sustainable Engineering	
	Renewable Energy Systems in Civil Infrastructure
	Renewable Energy Systems in Civil Infrastructure Lab
Additional Credits for Specialization Construction Technology	
	Building Information Modeling (BIM) and Construction Informatics
	Building Information Modeling (BIM) and Construction Informatics

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105111
Course Title	**Reinforced Concrete Structures**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Students will learn the concept of working stress method and limit state method for various reinforced concrete sections. Students will also learn the concept of design of one way, two way and circular slabs, short column and long column, axially and eccentrically loaded columns. Students will understand the concept of footings and retaining wall design as well.

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

CO1	Understand the behavior of structural members and the concept of RCC design.
CO2	Calculate the load carrying capacity of different types of RCC structural members for Civil Projects.
CO3	Design the safe RCC structural members keeping serviceability criteria in view.
CO4	Students will be made familiar with the BIS codes for structural design.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	2			3	3	3	3	3	3	2	1
CO2	3	3	3	3	2			3	3	3	3	3	3	3	1
CO3	3	3	3	3	2			3	3	3	2	3	3	3	1
CO4	3	2	2	2				3	1	1		1	3	1	1
Average	3	2.7	2.7	2.7	1.5			3	2.5	2.5	2	2.5	3	2.25	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**1**	**0**	**3**

Unit	Content

1	Basic knowledge and concept of reinforced concrete structure (plain concrete, steel) and design of concrete structure (C1, C2); basic concept of basic assumptions and permissible stresses in concrete and steel for working stress method C2 (Understanding), design and analysis of singly and doubly reinforced rectangular, T shaped beams in flexure using working stress method (C4, C6). Design of Sections in shear, bond and torsion, diagonal tension, shear reinforcement, development length, equivalent shear, Tensional reinforcement (C4, C6).
2	Basic concept of limit state method of design (C1, C2), Introduction to Limit state method, basic assumptions, design of singly and doubly reinforced rectangular, T shaped beams and inverted beam in flexure, minimum and maximum reinforcement requirement (C4, C6). Design of Sections in shear, bond and torsion, diagonal tension, shear reinforcement, development length, equivalent shear, Tensional reinforcement (C2, C4, C6).
3	Basic concept of slab and canopy (C1, C2), differentiate between one way and two-way slab C4 (Analysis), design and analysis of one-way slab, two-way slab and circular using limit state method (C4, C5, C6), design of canopy (C5, C6)
4	Basic understanding and classification of columns, footing and retaining wall (C1, C2); Design of short and slender columns by Limit State Method for axial load and combination of uniaxial and biaxial bending (C5, C6). Design of isolated footing and combined footing (C5, C6) using limit state method.

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	28
Practical	--
Seminar/Journal Club	2
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	5
Case/Project Based Learning (CBL)	--
Revision	–
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Text Books 1 RCC Designs, B.C Punmia (2012),10th Edition, ISBN No. 978-81-318-0942-6, Laxmi Publications **Reference books** 1. IS-456-2000. 2. SP-16(S&T)-1980, Design Aids for Reinforced Concrete to IS: 456, BIS, N.Delhi. 3. SP-34(S&T)-1987 Handbook on Concrete Reinforcement and Detailing`, BIS 4. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand &Bros., Roorkee. 5. Reinforced Concrete, I.C.Syal&A,K,Goel, A.H,Wheeler&Co.Delhi. 6. Reinforced Concrete Design, S.N.Sinha, TMH Pub., and N.Delhi.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Environmental Engineering**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge of this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pre-treatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society along with knowledge of distribution of water and requirement of building plumbing.

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

CO1	Know the type of unit operations and processes involved in water treatment plants.
CO2	Understand unit operations and processes required for satisfactory treatment of water.
CO3	Know the design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
CO4	Design water treatment units in a cost effective and sustainable way and to evaluate its performance to meet the desired health and environment related goals.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	3	3	2		3	3	3	2	3	2	2	3	2	1
CO2	2	2	3	2		3	2	3	3	3	3	3	3	2	1
CO3	3	3	3	3		3	3	3	3	3	2	3	3	3	1
CO4	3	3	3	3		3	3	3	2	2	2	2	3	3	1
Average	2.5	2.8	3	2.5		3	2.8	3	2.5	2.8	2.2	2.5	3	2.5	1

<table>
<tr><td colspan="5">Course Content:</td></tr>
<tr><td colspan="2">L (Hours/Week)</td><td>T (Hours/Week)</td><td>P (Hours/Week)</td><td>Total Hour/Week</td></tr>
<tr><td colspan="2">3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Unit</td><td colspan="3">Content</td><td>Competencies</td></tr>
<tr><td>1</td><td colspan="4">Define the terms related to water quality and water quantity. C1 (Remember)
Understanding the importance and necessity of a water supply scheme, water demands and their variations, estimation of total water requirement, population forecasting, selection of a water supply source, impurities in water, their sanitary significance, and the physical and chemical properties of water. C2 (Understand)
Applying the principles of water quantity assessment, source selection, impurity analysis, and water quality standards. C3 (Application)
Analyzing the water demands, source selection, impurity analysis, and water quality standards in the context of a water supply scheme. C4 (Analysis)</td></tr>
<tr><td>2</td><td colspan="4">Define the terms related to water treatment process. C1 (Remember)
Understand the objectives of water treatment, different treatment processes, their sequence in a conventional treatment plant, sedimentation (plain and aided with coagulation), filtration (mechanism involved, types of filters, slow and rapid sand filtration units), disinfection principles, aeration, other water treatment processes, purification processes in natural systems, water softening, removal of taste and odor, advanced methods of water treatment, defluorination, and dissolved solids removal. C2 (Understand)
Apply the principles of water treatment processes and their sequence in a conventional treatment plant, including sedimentation, filtration, disinfection, aeration, and other specialized processes. C3 (Application)
Analyzing the objectives and effectiveness of water treatment processes, the sequence in a conventional treatment plant, and the suitability of specialized treatment methods. C4 (Analysis)</td></tr>
<tr><td>3</td><td colspan="4">Understand the concepts related to the conveyance of water, including intake structures, rising and gravity systems, dual systems, pumping systems and pumping stations, valves and appurtenances, pipe materials, pipe fittings, and operation and maintenance (O&M) of the conveyance system. C2 (Understand)
Apply the principles of conveyance system components, including intake structures, rising and gravity systems, dual systems, pumping systems and pumping stations, valves and appurtenances, pipe materials, pipe fittings, and O&M practices. C3 (Application)
Analyzing the efficiency, reliability, and performance of conveyance system components, as well as the effectiveness of O&M practices. C4 (Analysis)</td></tr>
<tr><td>4</td><td colspan="4">Understand the concepts related to the layout of a water distribution system, distribution reservoirs, water distribution networks, analysis of distribution networks, layout considerations, capacity and pressure requirements, leak detection, maintenance, and water supply in buildings and plumbing. C2 (Understand)
Apply the principles of distribution system layout, distribution reservoirs, water distribution networks, analysis of distribution networks, layout</td></tr>
</table>

	considerations, capacity and pressure requirements, leak detection, maintenance, and water supply in buildings and plumbing. C3 (Application) Analyzing the efficiency, reliability, and performance of distribution system layouts, distribution reservoirs, water distribution networks, leak detection techniques, maintenance practices, and plumbing systems. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Text books 1. S.K Garg, Water supply Engineering (2010), 20th Edition, ISBN No. 81-7409-120-3, Khanna Publications.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Environmental Engineering Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The Water Treatment and Supply System Lab offers practical training on various aspects of water treatment and distribution. Students will learn water quality analysis techniques, including testing parameters such as pH, turbidity, and chlorine levels. Students will evaluate system performance through experiments, data analysis, and propose improvements for efficient water supply systems.

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

CO1	Know the type of unit operations and processes involved in water treatment plants.
CO2	Understand unit operations and processes required for satisfactory treatment of water.
CO3	Know the design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
CO4	Design water treatment units in a cost effective and sustainable way and to evaluate its performance to meet the desired health and environment related goals.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	3	3	2		3	3	3	2	3	2	2	3	2	1
CO2	2	2	3	2		3	2	3	3	3	3	3	3	2	1
CO3	3	3	3	3		3	3	3	3	3	2	3	3	3	1
CO4	3	3	3	3		3	3	3	2	2	2	2	3	3	1
Average	2.5	2.8	3	2.5		3	2.8	3	2.5	2.8	2.2	2.5	3	2.5	1

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**2**	**2**

Experiment No.	**Content**	**Competencies**
1.	To determine the pH of a given water sample. C5 (Evaluate)	

2.	To determine the total solids, suspended solids, dissolved solids and volatile solids in wastewater. C5 (Evaluate)
3.	To determine the turbidity and specific conductivity of the given water samples. C5 (Evaluate)
4.	To determine the Alkalinity of given water sample. C5 (Evaluate)
5.	To determine total hardness, permanent hardness and temporary hardness for given water sample. C5 (Evaluate)
6.	To determine amount of sulphates in a given sample. C5 (Evaluate)
7.	To determine the optimum dosage of coagulant for turbidity removal of a given water sample. C5 (Evaluate)
8.	Determination of BOD C5 (Evaluate)
9.	Determination of COD C5 (Evaluate)
10.	To determine amount of Fluorides in a given sample. C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	12
Case/Project Based Learning (CBL)	
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	**Summative**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

<table>
<tr><td>Feedback Process</td><td>1. Student’s Feedback</td></tr>
<tr><td colspan="2">Students Feedback is taken through various steps
1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms</td></tr>
</table>

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106114
Course Title	**Highway Engineering**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Highway Engineering is a prominent aspect of surface transport. Highway engineering deals with planning, design, construction, operation and maintenance of all types of roads. During the course, the students will learn about the highway related tests on Soil, Bitumen and Aggregate. Students will also get familiar with the test on Modified Binder and modern techniques of highway construction along with use of modern highway construction materials. Course shall also contain design of Highway Engineering.

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

CO1	Design various geometric elements of highways.
CO2	Understand the various types of materials used in highway construction along with conducting specified test on the materials as per BSI code for their suitability.
CO3	Perform structural design of flexible and rigid pavements.
CO4	Know various highway constructions techniques and its maintenance

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3			3	2	3	2	3	3	3	2
CO2	3	3	3	3	2	2	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	3			3	2	2	2	2	3	3	2
CO4	3	3	3	2	3		2	2	3	3	2	3	3	2	2
Average	3	3	3	2.8	2.8	0.5	1.2	2.8	2.5	2.8	2.2	2.8	3	2.75	2

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	**Content**	**Competencies**
1	Understand the concepts related to transportation engineering, including the introduction to transportation engineering and modes of transportation, types	

	of engineering surveys for highway alignment, classification of roads, cross-sectional elements, and sight distances. C2 (Understand) Apply the principles of transportation engineering, including the modes of transportation, types of engineering surveys for highway alignment, classification of roads, cross-sectional elements, and sight distances. C3 (Application) Analyze the efficiency, effectiveness, and safety of transportation engineering concepts such as modes of transportation, engineering surveys for highway alignment, road classification, cross-sectional elements, and sight distances. C4 (Analysis)
2	Understand the concepts related to the geometric design of horizontal and vertical alignment, horizontal curve design, super elevation, extra widening, transition curves, setback distance, vertical curve design, and design of highways/expressways. C2 (Understand) Apply the principles of geometric design to develop horizontal and vertical alignments, design horizontal curves, determine super elevation, extra widening, and transition curves, establish setback distances, design vertical curves, and design highways/expressways. C3 (Application) Analyze the efficiency, effectiveness, and safety of geometric design principles for horizontal and vertical alignment, horizontal curve design, super elevation, extra widening, transition curves, setback distance, vertical curve design, and design of highways/expressways. C4 (Analysis)
3	Understand the concepts related to the introduction to traffic engineering, traffic characteristics, traffic study and analysis, traffic volume study, traffic speed study, traffic flow characteristics, and traffic intersection design. C2 (Understand) Apply the principles of traffic engineering to analyze traffic characteristics, conduct traffic volume studies, traffic speed studies, analyze traffic flow characteristics, and design traffic intersections. C3 (Application) Analyze the efficiency, effectiveness, and safety of traffic characteristics, traffic study and analysis, traffic volume study, traffic speed study, traffic flow characteristics, and traffic intersection design. C4 (Analysis)
4	Understand the concepts related to pavement materials, including soil, aggregate, bitumen, cement, and unconventional materials. Gain knowledge about pavement material testing and specification. Understand the principles and concepts behind the design of flexible and rigid pavements. C2 (Understand) Apply the principles of pavement materials and their testing in the selection and specification of materials for pavement construction. Apply the principles of pavement design to determine the appropriate thickness and layer composition for flexible and rigid pavements. C3 (Application) Analyze the performance and suitability of pavement materials based on their properties and testing results. Evaluate the design of flexible and rigid pavements in terms of their structural integrity and performance under traffic loads. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

References:	
	<u>Text Books</u> S.K. Khanna, C.E.G. Justo & A. Veeragavan (2014),10th Edition, ISBN No. 978-81-85-240-72-05, Highway Engineering, Nem Chand and Bros **<u>References</u>** 1. S.C. Rangwala, Highway Engineering. 2. Roger L. Brockenbrough, Highway Engineering Handbook.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106115
Course Title	**Highway Engineering Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Highway Engineering is a prominent aspect of surface transport. Highway engineering deals with planning, design, construction, operation and maintenance of all types of roads. During the course, the students will learn about the highway related tests on Soil, Bitumen and Aggregate. Students will also get familiar with the test on Modified Binder and modern techniques of highway construction along with use of modern highway construction materials. Course shall also contain design of Highway Engineering.

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

CO1	Design various geometric elements of highways.
CO2	Understand the various type of materials used in highway construction along with conducting specified test on the materials as per BSI code for their suitability.
CO3	Perform structural design of flexible and rigid pavements.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	3			3	2	3	2	3	3	3	2
CO2	3	3	3	3	2	2	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	3			3	2	2	2	2	3	3	2
Average	3	3	3	3	3	6	1	3	2.3	2.6	2.3	2.6	3	3	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	2	1

Experiment No.	Content	Competencies
1.	Aggregate Impact Test. C5 (Evaluate)	
2.	Los-Angeles Abrasion Test on Aggregates. C5 (Evaluate)	
3.	Dorry's Abrasion Test on Aggregates. C5 (Evaluate)	
4.	Deval Attrition Test on Aggregates. C5 (Evaluate)	
5.	Crushing Strength Test on Aggregates C5 (Evaluate)	

6.	Penetration Index Test on Bitumen C5 (Evaluate)
7.	Ductility Test on Bitumen. C5 (Evaluate)
8.	Viscosity Test on Bituminous Material. C5 (Evaluate)
9.	Flash and Fire Point Test on Bitumen C5 (Evaluate)
10.	Flakiness and elongation test C4 (Analyze)
11.	Marshal Stability test C4 (Analyze), C5 (Evaluate)
12.	C B R Value test. C4 (Analyze), C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	12
Case/Project Based Learning (CBL)	
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Numerical Methods**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	Basic knowledge of calculus and linear algebra
Course Synopsis	This course introduces numerical techniques essential for solving civil engineering problems where analytical methods are impractical. Topics include solving equations, interpolation, numerical integration, and differential equations, with an emphasis on algorithmic thinking and application through software tools. This course enables students to build computational proficiency to support civil engineering design and analysis.

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

CO1	Apply numerical methods to solve algebraic and transcendental equations.
CO2	Utilize interpolation techniques and numerical differentiation/integration for engineering problems.
CO3	Implement numerical solutions to ordinary differential equations.
CO4	Analyze civil engineering problems using numerical techniques and tools like MATLAB or Python.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**P O1**	**P O2**	**P O3**	**P O4**	**P O5**	**P O6**	**P O7**	**P O8**	**P O9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	3	3	3			3	2	3	2	3	3	3	2
CO2	3	3	3	3	2	2	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	3			3	2	2	2	2	3	3	2
CO4	3	3	3	2	3		2	2	3	3	2	3	3	2	2
Average	3	3	3	2.8	2.8	0.5	1.2	2.8	2.5	2.8	2.2	2.8	3	2.75	2

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	**Content**	**Competencies**
1	Bisection method uses intermediate value theorem to iteratively converge towards the root of a nonlinear equation (C2 – Understand). Regula-Falsi method improves upon the bisection approach by employing linear	

	interpolation between bracketing values (C3 – Apply). Newton-Raphson method applies tangent line approximations to iteratively locate roots with quadratic convergence, suitable for equations with differentiable functions (C4 – Analyze). Comparative study of all three methods highlights differences in convergence speed, reliability, and computational efficiency (C4 – Analyze).
2	Newton's forward and backward interpolation techniques develop polynomial expressions for estimating values at intermediate points within equally spaced datasets (C2 – Understand). Lagrange's interpolation formula is applied to construct polynomials when data points are unevenly spaced (C3 – Apply). Divided difference methods and Newton's general interpolation formula extend interpolation to more generalized data, providing flexibility and error control (C4 – Analyze). Numerical differentiation utilizes interpolating polynomials to compute first and second derivatives at tabulated points (C3 – Apply). Trapezoidal rule approximates definite integrals by dividing the interval into trapezoids, offering a basic numerical integration technique (C2 – Understand). Simpson's 1/3 and 3/8 rules use quadratic and cubic approximations to improve integration accuracy (C3 – Apply). Error analysis examines the accuracy and suitability of each integration method based on interval size and function behavior (C4 – Analyze).
3	Gauss elimination method systematically eliminates variables to reduce a system of equations to upper triangular form for back substitution (C2 – Understand). Gauss-Jordan method further simplifies the matrix to reduced row-echelon form to find direct solutions (C3 – Apply). LU decomposition splits the matrix into lower and upper triangular components to solve linear systems efficiently, particularly for repeated solutions with different right-hand sides (C3 – Apply). Gauss-Seidel iterative method successively improves approximate solutions, with analysis of its convergence behavior under various matrix conditions (C4 – Analyze). Matrix inversion method applies inverse matrices to compute the solution vector, appropriate for small, well-conditioned systems (C3 – Apply).
4	Taylor series method expands the solution of an ODE into an infinite series truncated for approximation, relying on successive derivatives (C2 – Understand). Euler's method applies a first-order finite difference approach to approximate solutions step-by-step over the integration interval (C3 – Apply). Modified Euler's method improves accuracy by averaging slopes at the beginning and end of each interval (C3 – Apply). Runge-Kutta methods, especially second and fourth order, provide highly accurate solutions using weighted average slopes, balancing computational cost with precision (C3 – Apply). Error analysis quantifies the local and global errors and evaluates the stability and convergence characteristics of numerical methods (C4 – Analyze). Application of these methods to civil engineering problems, such as groundwater flow modeling or structural response under dynamic loading, connects theory to practical problem-solving (C4 – Analyze).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	2. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

References:	
	<u>Text Books</u> S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Pvt. Ltd., Latest Edition. B.S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, Latest Edition.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105116
Course Title	**BIM Lab**
Academic Year	III
Semester	V
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Building Information Modeling (BIM) is the foundation of digital transformation in the architecture, engineering, and construction (AEC) industry. As the leader in BIM, Autodesk is the industry's partner to realize better ways of working and better outcomes for business and the built world.

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

CO1	Modelling of structure
CO2	Analysis of Structure
CO3	Level and analysis of structure

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P01 2	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1		2		2	2	1		1	3	2	1
CO2	3	2		1		1	1	1	1	1	1	1	3	2	2
CO3	3	2	2	1		1	1	2	2	2	2	2	3	2	2
Average	3	2.3	1.8	1	0.8	1.3	1	1.8	1.8	1.3	1.8	1.8	3	2	1.67

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	4	4

Experiment No.	Content
1.	Basic concept of BIM C1 (Remember)
2.	Create Model of structure C3 (Application)
3.	Level for the building C3 (Application)
4.	Analysis of structure using Revit C4 (Analysis)
5.	MEP in structure C3 (Application)
6.	Analysis of MEP of building C4 (Analysis)
7.	Create model and analysis of any building (C3, C4)
8.	Case study C3 (Application)
9.	Modelling and analysis of two Storey building using Revit (C4, C6)
10.	Modelling and analysis of Multi-Storey building using Revit (C4, C6)

11.	Case studies on the analysis of Multi-Storey building (C4, C5)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	36
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	20
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	Personality Development & Career Building
Academic Year	III
Semester	V
Number of Credits	NIL
Course Prerequisite	NIL
Course Synopsis	This course aims to develop essential personal and professional skills in engineering students to enhance their employability and effectiveness in the workplace. It focuses on communication, confidence building, interpersonal behavior, presentation skills, group discussions, interview techniques, goal setting, and career planning. The course also helps students develop a positive attitude, emotional intelligence, time management, and ethical behavior aligned with corporate expectations.

Course Outcomes:

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

CO1	Demonstrate improved self-awareness, confidence, and interpersonal effectiveness.
CO2	Communicate effectively in both verbal and non-verbal forms during interviews, presentations, and group interactions.
CO3	Apply time management, emotional intelligence, and stress management strategies in personal and professional contexts.
CO4	Prepare effective career development plans including CV writing, job search strategies, and interview readiness.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)& Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	2	3	3	3	3	2	2	-	-	-
CO2	2	-	-	-	-	2	2	3	3	3	2	2	-	-	-
CO3	2	-	-	-	-	2	3	3	2	2	2	2	-	-	-
CO4	2	-	-	-	-	2	2	3	3	3	2	2	-	-	-

Average	2	0	0	0	0	2	2.5	3	2.75	2.75	2	2	0	0	0

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content & Competencies
1	**Self-Discovery and Personality Development (C2–C3)** • Self-awareness and SWOT analysis • Confidence building and positive thinking • Developing emotional intelligence and empathy • Body language, grooming, and etiquette
2	**Communication and Presentation Skills (C2–C4)** • Verbal and non-verbal communication • Listening and assertiveness skills • Public speaking and presentation techniques • Group discussion techniques and mock GDs
3	**Career Planning and Professional Development (C2–C4)** • Goal setting and time management • Resume/CV writing and cover letters • Job search strategies and networking • Facing personal interviews: HR and technical rounds • Understanding workplace behavior and corporate expectations
4	**Stress Management, Leadership & Ethics (C2–C3)** • Stress and conflict management • Leadership qualities and team-building exercises • Decision making and problem-solving • Ethical behavior and workplace values • Case studies on professional dilemmas and career growth

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	19
Practical	--
Seminar/Journal Club	2

Small Group Discussion (SGD)	5
Self-Directed Learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	2
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2 (Mid Term 3 is optional)
Assignments	University End Term Examination
Student Seminar	Project
Problem Based Learning (PBL)	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Assignment / Presentation	✓	✓	✓	✓
Mid Semester Examination 1	✓	✓	✓	✓
Mid Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓
Feedback Process	1. Student's Feedback 2. Course Exit Survey			

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of semester.

Program Elective – I

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105115
Course Title	**Engineering Geology**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Engineering Geology is the application of the geological sciences to Civil Engineering practice for the purpose of recognizing the location, design, construction, operation and maintenance of engineering projects such as Dams, Barrages, Bridges, High rise buildings and other such important projects.

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

CO1	Characterize and classify various minerals and rocks on the basis of their engineering properties.
CO2	Identify the exterior and interior structure of various features of rocks
CO3	Analysis subsurface information and groundwater potential sites through geophysical investigations
CO4	Understand the recent advancement in the field of geology and Apply geological principles and techniques for mitigation of natural hazards and select sites for dams and tunnels.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**P O1**	**P O2**	**P O3**	**P O4**	**P O5**	**P O6**	**P O7**	**P O8**	**P O9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	3	3	3			3	2	3	2	3	3	1	1
CO2	3	3	3	3	2	2	3	3	3	3	3	3	3	1	1
CO3	3	3	3	3	3			3	2	2	2	2	3	1	2
CO4	3	3	3	2	3		2	2	3	3	2	3	3	1	1
Average	3	3	3	2.8	2.8	0.5	1.3	2.8	2.5	2.8	2.3	2.8	3	1	1.25

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	Content
1	Definition of a crystal and mineral C1 (Remember); relationship between crystals and minerals C4 (Analysis); describe the physical properties used in mineral identification and rock-forming minerals such as quartz and its varieties, feldspar, hornblende, olivine, mica, garnet, kyanite, calcite, talc, bauxite, corundum, gypsum, fluorite, apatite, barite, asbestos, magnetite, hematite C2 (Understanding); Analyze the formation processes of rocks and the factors influencing their classification C4 (Analysis); Describe and compare the texture, structure and properties of granite, pegmatite, dolerite, gabbro, basalt, sandstone, conglomerate, breccia, limestone, shale, laterite, schist, gneiss, quartzite, marble and slate C4 (Analysis)
2	Concept of geological map C2 (Understanding); types and classifications of folds, faults, joints, and unconformities C2 (Understanding); application of geological maps in understanding the Earth's surface C3 (Application); Analyze the characteristics of outcrops to infer the geological history of an area C4 (Analysis); Evaluate the impact of different types of folds, faults, joints, and unconformities on the geological evolution of an area C5 (Evaluate)
3	Analyze the factors and processes contributing to rock decay and weathering C4 (Analysis); Analyze the stability of rock based on geological and geotechnical factors C4 (Analysis); Evaluate the impact of rock decay and weathering on engineering structures and landscapes C5 (Evaluate)
4	Analyze the causes and effects of earthquakes and landslides along with the remedial measures C4 (Analysis); Evaluate the impact of earthquakes and landslides on the safety and stability of engineering structures C5 (Evaluate); Evaluate the significance and implications of recent developments in engineering geology C5 (Evaluate); Analyze the challenges and opportunities in the field of engineering geology C4 (Analysis).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	28
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	7
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	

Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Text Books S.K Garg, Physical and Engineering Geology (2012), 7th Edition ISBN No. 81-7409-032-0, Khanna Publications. **References** 1. Reddy, V. Engineering Geology for Civil Engineers; Oxford & IBH, 1997,New Delhi 2. N. Chennakesavalu, A Test Book of Engineering Geology, Macmillan Publishers, First Publishers, Published 2004

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Advance Geomatics Engineering**
Academic Year	II
Semester	V
Number of Credits	3
Course Prerequisite	Surveying
Course Synopsis	Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

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

CO1	Prepare Topographical maps & surveyed site plans for civil projects.
CO2	They will be able to transfer map/drawing/layout plan on the actual site of civil projects.
CO3	Carry out tachometry, geodetic surveying wherever situation demands.
CO4	Apply error adjustment to the recorded reading to get an accurate surveying output.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	1	1	1	2	1	1	3	1	2
CO2	3	3	3	3	2	2	2	1	1	1	1	1	3	1	1
CO3	3	3	3	3	2	2	1	2	2	1	2	1	3	1	2
CO4	3	3	3	3	2	2	1	1	1	1	1	1	3	1	2
Average	3	3	3	3	2	2	1	1	1	1	1	1	3	1	1.75

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content
1	Basic understanding and concept of curves (C1, C2); differentiate the different types of curves such as simple circular curve, compound and

	reverse curves, transition curve C4 (Analysis), discuss the elements of compound and reverse curve C2 (Understanding); Compare the various types of transition curve and vertical curves C4 (Analysis)
2	Basic concept of Maps & their numbering, Global Positioning System, Geo referencing and datums C2 (Understanding), Application of GPS in surveying C3 (Application); Compare Map projection and co-ordinate system C4 (Analysis)
3	Basic understanding and concept of Geographical Information System C2 (Understanding); Compare spatial and non-spatial GIS data C4 (Analysis), Distinguish raster and vector data (C3, C4); evolution and application of GIS in interdisciplinary area C3 (Application)
4	Basic concept of remote sensing and its characteristics (C1, C2); Application of remote sensing in surveying C3 (Application); distinguish the different types of remote sensing C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	32
Practical	--
Seminar/Journal Club	04
Small group discussion (SGD)	04
Self-directed learning (SDL) / Tutorial	05
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	Student's Feedback

<table>
<tr><td colspan="2">Students Feedback is taken through various steps
1.Regular feedback through Mentor Mentee system
2.Feedback between the semester through google forms</td></tr>
<tr><td>References:</td><td></td></tr>
<tr><td></td><td>Text Books
1. Punmia B.C, Surveying (2011), Volume 1, 2, 3 Sixteenth edition, ISBN No. 81-7008-853-4, Laxmi Publications.
Reference Books
1. Subramanian R, Surveying and Levelling, Publication Oxford University Press.
2.Kanetkar T.P, Surveying and Levelling, Vol II, Pune</td></tr>
</table>

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Open Channel Flow**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	Fluid Mechanics
Course Synopsis	In this course, student will learn about open channel hydraulics: Pipe Flow and Free Surface Flow, Continuity Equation, Energy in Free Surface Flow, Basic Momentum Equation, Velocity Distribution, Occurrence, Critical Depth in Trapezoidal & Circular Channels, Hydraulic Exponent for Critical Flow, Critical Flow Depth Computations, Derivation of Uniform Flow Equations, Resistance in Open Channel Hydraulics, History of Uniform Flow Velocity and Resistance Factor, Integration of Differential Equation, Improved Euler Method, Fourth-order Runga-Kutta Method, Classification of Jumps, Momentum Equation, General Hydraulic Jump Equation, Energy loss in the Jump, Turbulent Characteristics of the Jump.

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

CO1	Know the various types of flows in open channels.
CO2	Determine velocity distribution across and along the channel and hydraulic jumps.
CO3	Design the channel sections, drains and jumps for various hydraulic and hydrologic projects.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	3	2	1
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	3	1	1
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**	3	1	1
Average	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**	3	1.33	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content
1	Understanding of pipe flow, energy, continuity equation and free surface flow C2 (Understanding); Apply the continuity equation to solve problems related to fluid flow and mass conservation C3 (Application); difference between pipe flow and free surface flow and their respective characteristics C4 (Analysis); Analyze the continuity equation, Basic Momentum Equation, energy principle and its applications in fluid dynamics C4 (Analysis); Evaluate the accuracy and precision of velocity measurement methods for flow analysis C5 (Evaluate); Application of the velocity-area method to estimate river discharges and radio-active tracer technique to measure flow rates in rivers C3 (Application)
2	Understand the characteristics and importance of critical flow in open channels C2 (Understanding), Understand the principles and operation of flow measurement devices such as flumes and weirs C2 (Understanding); Comprehend the concept of brink depth and its relationship to flow measurements C2 (Understanding); Apply the principles of flow measurement to select and use appropriate devices for accurate flow measurement C3 (Application); Apply the concept of brink depth to determine the correct positioning of flow measurement devices C3 (Application); Analyze the characteristics and behavior of critical flow in open channels C4 (Analysis); Analyze the advantages and limitations of different flow measurement devices and techniques C4 (Analysis); Analyze the design and performance of weirs and control structures in flow measurement applications C4 (Analysis); Evaluate the significance and accuracy of different methods for determining critical depth C5 (Evaluate)
3	Concept of Uniform Flow C2 (Understanding); Derivation of Uniform Flow Equations C5 (Evaluate); Analyze the resistance in Open Channel Hydraulics C4 (Analysis); Ganguillet and Kutter Formula C6 (Create)
4	Classify the Gradually Varied Flow Profiles C2 (Understanding); Sketching of Composite Water Surface Profiles C3 (Application); Computation of Gradually Varied Flow C5 (Evaluate), Derive Dynamic Equation for Steady Gradually Varied Flow C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	29
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	12
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	04
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3
Peer Group activities	✓	✓	✓
Quiz	✓	✓	✓
Seminars	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓
Comprehensive assessment	✓	✓	✓
University End Term Examination	✓	✓	✓

Feedback Process	Student's Feedback
Students Feedback is taken through various steps 1.Regular feedback through Mentor Mentee system 2.Feedback between the semester through google forms	
References:	
	Text Books 1. Subramanya,K.,(2008) Flow in Open Channels,3rd Edition, ISBN No. 978-132-449-6, TataMcGraw-Hill **Reference Books** 1.V.T.Chow (2009), Open Channel Hydraulics, Blackburn Press. 2. Asawa,G.L.,(2010), Fluid Flowing Pipes and Channels, CBS Publishers. 3. Chanson, H.(2004),The Hydraulics of Open Channel Flow: An Introduction, Elsevier Scientific. 4. M. Hanif Chaudhry (2007), Open Channel Flow, Springer. 5. Henderson, F.M., (1966) Open Channel Flow, PHI.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105118
Course Title	**Advanced Structural Analysis**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	Structural analysis
Course Synopsis	Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures

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

CO1	Identify the method of analysis for determinate structures
CO2	Understand the importance of various methods of slop and deflections for determinate structures.
CO3	Use the influence line diagram.
CO4	Understand the methods of analysis for multi-storeyed frames

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	1	1	1	1	1	1	3	1	1
CO2	3	3	3	3	2	2	2	1	2	1	1	1	3	1	1
CO3	3	3	3	3	2	2	1	1	1	1	1	1	3	1	-
CO4	3	3	3	3	2	2	1	1	1	2	1	1	3	1	-
Average	3	3	3	3	2		1.67	1	1.67	1.567	1	1	3	1	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content
1	Concept of redundancy, restraint, lack of fit, temperature changes and support settlement C2 (Understanding); Analysis of beams, frames and trusses with internal and external redundancy (C4, C5, C6)
2	Understanding of cables C2 (Understanding); Analysis and determination of forces in cables under concentrated and uniformly distributed loads (C4, C5, C6) Basic concept of finite element method C1 (Remember); differentiate elements, element shapes, nodes, shape function C4 (Analysis)
3	Concept of flexibility matrix C2 (Understanding), analysis of beam and frame using flexibility matrix method (C4, C5)
4	Basic concept of stiffness matrix C1 (Remember); analysis of beam and frame using stiffness matrix method (C4, C5)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	31
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	4
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	Student's Feedback
Students Feedback is taken through various steps	

1.Regular feedback through Mentor Mentee system 2.Feedback between the semester through google forms	
References:	
	Text Books 1. R.C. Hibbler , Structural Analysis (2011) , Pearson Education **Reference Books** 1. Jain, O.P. and Jain, B.K., “Theory & Analysis of Structures ”. Vol .I&; II Nem Chand brothers. 2. Wilbur and Norris, “Elementary Structural Analysis”, Tata McGraw Hill 3. .Coates,R.C.,Coutie,M.G. & Kong, F.K., “Structural Analysis”, English Language, Book Society & Nelson.

Course for Specialization

Structural Engineering

Introduction to Finite Element analysis	3	0	0	3
Introduction to Finite Element analysis Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Introduction to Finite Element analysis**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course introduces the finite element method as a tool for solving engineering problems. Students learn the formulation and application of FEM for 1D and 2D structural elements. It includes numerical procedures, element assembly, and practical implementation of boundary conditions. Basic use of FEM software is also covered to prepare for real-world analysis.

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

CO1	Understand the fundamental principles and steps of the finite element method.
CO2	Apply FEM concepts to formulate and solve simple 1D and 2D structural problems.
CO3	Evaluate stiffness matrices and interpret results for bar, truss, and CST elements.
CO4	Use FEM software tools for basic problem modeling, analysis, and interpretation of results.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	**Content**	**Competencies**
1	The finite element method (FEM) is introduced as a numerical technique for solving boundary value problems. Steps of FEM—discretization, selection of element type, formulation, assembly, and solution—are covered. The concept of nodes, elements, degrees of freedom, and	

	interpolation functions is explained. C1 (Remember), C2 (Understand), C3 (Apply) Direct stiffness method and matrix formulation for spring and bar elements are introduced. C2 (Understand), C3 (Apply), C4 (Analyze)
2	Formulation for 1D bar, truss, and axial elements using potential energy and Galerkin's approach is discussed. C1 (Remember), C2 (Understand), C3 (Apply) Assembly of global stiffness matrix, application of boundary conditions, and solution of the system of equations are demonstrated. C3 (Apply), C4 (Analyze) Concepts of stress and strain recovery, and convergence and compatibility are introduced. C2 (Understand), C4 (Analyze), C5 (Evaluate)
3	Introduction to 2D CST (Constant Strain Triangle) elements and their stiffness matrix formulation. C1 (Remember), C2 (Understand), C3 (Apply) Transformation of coordinates, isoparametric elements, and numerical integration using Gauss quadrature are discussed. C2 (Understand), C3 (Apply), C4 (Analyze), C5 (Evaluate) Application to plane stress, plane strain problems, and simple case studies. C3 (Apply), C4 (Analyze), C5 (Evaluate)
4	Application of FEM in structural, thermal, and fluid problems is discussed with illustrative examples. C2 (Understand), C3 (Apply), C5 (Evaluate) Overview of commercial FEM tools like ANSYS, ABAQUS, and application of pre-processing, meshing, and post-processing. C2 (Understand), C3 (Apply), C4 (Analyze) Introduction to modeling simple 1D and 2D problems using FEM software. C3 (Apply), C4 (Analyze), C6 (Create)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	25
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	

Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:

Text Books

1. "Introduction to Finite Elements in Engineering" – T. R. Chandrupatla and A. D. Belegundu
2. "The Finite Element Method: Its Basis and Fundamentals" – O. C. Zienkiewicz, R. L. Taylor, and J. Z. Zhu
3. "A First Course in the Finite Element Method" – Daryl L. Logan
4. "Finite Element Analysis: Theory and Programming" – C. S. Krishnamoorthy

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Introduction to Finite Element analysis Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

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

CO1	Understand complexity of Machine Learning algorithms and their limitations.
CO2	Understand modern notions in data analysis-oriented computing.
CO3	Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own.
CO4	Be capable of performing experiments in Machine Learning using real-world data.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**2**	**2**

Experiment No.	**Content**
1.	Manual computation of nodal displacements and stresses in a 1D axial bar using the direct stiffness method.
2.	Development of element stiffness matrix for a 2D truss element using FEM principles.
3.	Numerical solution of a bar under axial load using Galerkin’s approach.
4.	Formulation and solution of a 1D heat conduction problem using FEM.
5.	Modeling and analysis of a cantilever beam under point load using FEM software.
6.	Static analysis of a 2D truss using FEM software and interpretation of results (stress, strain).

7.	Generation of global stiffness matrix for CST element manually and verification through software.
8.	Use of Gauss quadrature for numerical integration in isoparametric elements.
9.	Meshing of 2D geometry and performing plane stress analysis using FEM software.
10.	Complete modeling, boundary condition setup, and result extraction of a mechanical component.

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

AssessmFeedback Process	1. Student’s Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Course for Specialization

Green Technology and Sustainable Engineering

Renewable Energy Systems in Civil Infrastructure	3	0	0	3
Renewable Energy Systems in Civil Infrastructure Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Renewable Energy Systems in Civil Infrastructure**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	The course introduces students to the fundamentals of renewable energy and its integration into civil infrastructure. It focuses on the technical, environmental, and economic aspects of various renewable energy sources such as solar, wind, biomass, and small hydropower systems. Emphasis is placed on the application of these systems in buildings, urban infrastructure, and water management projects. Students will learn to evaluate, design, and integrate renewable energy technologies in sustainable civil engineering solutions.

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

CO1	Understand the principles and types of renewable energy systems relevant to civil engineering.
CO2	Analyze the applicability and efficiency of renewable energy technologies in civil infrastructure.
CO3	Design small-scale renewable energy systems integrated into buildings, water, and waste management.
CO4	Evaluate the techno-economic feasibility and environmental impact of renewable energy projects in infrastructure planning.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-

Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies
1	Classification of energy sources; advantages of renewable energy; global and national energy scenarios; basic concepts of solar, wind, hydro, biomass, and geothermal energy (C2 – Understand). Role of renewable energy in sustainable civil infrastructure development (C2 – Understand). Integration of renewables in urban and rural contexts (C3 – Apply).	
2	Solar radiation principles; photovoltaic systems; passive and active solar thermal systems (C2 – Understand). Application in buildings: solar water heating, solar lighting, and rooftop solar power systems (C3 – Apply). Design considerations and sizing of solar PV systems for buildings and water pumping (C3 – Apply). Analysis of solar project feasibility and energy yield estimation (C4 – Analyze).	
3	Basics of wind energy conversion; types of wind turbines; wind resource assessment; use in water pumping and rural microgrids (C2 – Understand, C3 – Apply). Biomass resources, digestion and gasification technologies (C2 – Understand). Integration of biomass in waste-to-energy and decentralized energy systems (C3 – Apply). Environmental benefits and lifecycle assessment (C4 – Analyze).	
4	Introduction to micro and small hydropower systems; site selection and civil components (C2 – Understand). Geothermal energy and its use in heating and cooling buildings (C3 – Apply). Hybrid systems combining multiple renewable sources for off-grid applications (C3 – Apply). Evaluation of hybrid energy systems for cost, reliability, and performance (C4 – Analyze).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--

Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

References:	
	Text Books 1. S.P. Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw-Hill. 2. B.H. Khan, Non-Conventional Energy Resources, McGraw Hill Education. **Reference Books** 1. **G.D. Rai**, *Non-Conventional Energy Sources*, Khanna Publishers. 2. **Chetan Singh Solanki**, *Solar Photovoltaics: Fundamentals, Technologies and Applications*, PHI Learning. 3. **D.P. Kothari, K.C. Singal and Rakesh Ranjan**, *Renewable Energy Sources and Emerging Technologies*, PHI Learning. 4. **J.F. Manwell, J.G. McGowan, A.L. Rogers**, *Wind Energy Explained: Theory, Design and Application*, Wiley. 5. Reports by **MNRE (Ministry of New and Renewable Energy, Government of India)** and **International Renewable Energy Agency (IRENA)**.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology

Course Code	
Course Title	**Renewable Energy Systems in Civil Infrastructure Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab course complements the theory course by providing hands-on experience with renewable energy systems applicable to civil infrastructure. Students will perform experiments related to solar, wind, biomass, and hybrid systems, and analyze their operational parameters, efficiencies, and feasibility in engineering applications. The course encourages system design thinking and real-world implementation of clean energy solutions in buildings, water systems, and urban infrastructure.

Course Outcomes:

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

CO1	Operate and test solar photovoltaic and thermal systems used in infrastructure.
CO2	Assess wind and biomass energy systems through experimental measurements.
CO3	Evaluate the integration of renewable energy systems in civil infrastructure using design and simulation tools.
CO4	Analyze and interpret performance data and calculate energy output, efficiency, and sustainability metrics.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	2	2

Experiment No.	Content
1.	Measurement of solar radiation using pyranometer and sun path tracking
2.	Performance testing of solar photovoltaic (PV) panel under varying irradiance and load conditions
3.	Determination of efficiency of a flat plate solar thermal collector
4.	Study and simulation of a rooftop solar PV system using software (e.g., PVsyst or Helioscope)
5.	Wind turbine performance evaluation under controlled wind tunnel setup
6.	Biomass gasifier demonstration and measurement of calorific value of biomass fuel
7.	Design of a small off-grid hybrid renewable energy system (solar-wind-battery)
8.	Study of geothermal heat pump system for building cooling applications
9.	Performance assessment of a solar water pumping system
10.	Life cycle assessment (LCA) or carbon footprint estimation of a renewable energy setup in infrastructure

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce

Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

Course for Specialization

Construction Technology

Building Information Modeling (BIM) and Construction Informatics	3	0	0	3
Building Information Modeling (BIM) and Construction Informatics Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Building Information Modeling (BIM) and Construction Informatics**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course introduces students to the concepts, tools, and processes of Building Information Modeling (BIM) and its role in modern construction informatics. It focuses on BIM-based design, data modeling, digital collaboration, lifecycle information management, and integration with construction technologies such as 4D/5D simulation and Geographic Information Systems (GIS). The course aims to develop the ability to apply digital workflows and intelligent models for efficient project delivery in civil engineering.

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

CO1	Understand the principles, processes, and advantages of BIM in the civil construction lifecycle.
CO2	Apply BIM tools and workflows to model and visualize building and infrastructure projects.
CO3	Analyze interoperability, collaboration, and information exchange standards in BIM environments.
CO4	Evaluate BIM's integration with scheduling, costing, GIS, IoT, and facility management for smart construction.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-

CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Introduction to BIM concepts, digital construction processes, and evolution from CAD to BIM (C2 – Understand). BIM dimensions (3D to 7D), information modeling principles, and components of a BIM environment (C2 – Understand). Overview of construction informatics, digital twins, and Industry 4.0 applications (C3 – Apply).	
2	BIM authoring tools and software (e.g., Autodesk Revit, ArchiCAD, Bentley)* (C2 – Understand). Creation of 3D models for architectural, structural, and MEP systems (C3 – Apply). Parametric modeling, family creation, and clash detection (C3 – Apply). Model validation and walkthrough visualization (C4 – Analyze).	
3	File formats and standards (IFC, COBie); model coordination and federated modeling (C2 – Understand). Collaboration platforms and cloud-based BIM tools (e.g., BIM 360) (C3 – Apply). Interdisciplinary communication and model sharing protocols (C4 – Analyze). BIM Execution Plan (BEP) and Level of Development (LOD) specifications (C4 – Analyze).	
4	4D (time) and 5D (cost) simulations; linking BIM with project scheduling tools (C3 – Apply). Integration of BIM with GIS for infrastructure planning (C4 – Analyze). Facility management, lifecycle data, and IoT-based smart building concepts (C4 – Analyze). Legal, ethical, and data security aspects in construction informatics (C2 – Understand).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--

Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. **Chuck Eastman, Paul Teicholz et al.**, *BIM Handbook: A Guide to Building Information Modeling*, Wiley. 2. **Rafael Sacks, Chuck Eastman**, *Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations*, McGraw-Hill.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Building Information Modeling (BIM) and Construction Informatics Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This course introduces students to the concepts, tools, and processes of Building Information Modeling (BIM) and its role in modern construction informatics. It focuses on BIM-based design, data modeling, digital collaboration, lifecycle information management, and integration with construction technologies such as 4D/5D simulation and Geographic Information Systems (GIS). The course aims to develop the ability to apply digital workflows and intelligent models for efficient project delivery in civil engineering.

Course Outcomes:

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

CO1	Use BIM software for creating 3D architectural and structural models.
CO2	Perform clash detection, quantity take-off, and cost estimation using BIM tools.
CO3	Simulate construction sequencing using 4D BIM.
CO4	Integrate BIM models with GIS and analyze their use in facility and asset management.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Introduction to BIM interface and navigation using Revit or equivalent			
2.	Creation of 3D architectural model from 2D plans			
3.	Modeling of structural elements (columns, beams, slabs) in BIM			
4.	Inserting and editing MEP components in a BIM model			
5.	Clash detection between structural and MEP systems using Navisworks or Revit			
6.	Quantity take-off and material estimation from BIM model			
7.	Linking BIM model with project schedule for 4D simulation			
8.	Cost estimation and 5D BIM analysis using Navisworks/CostX			
9.	Exporting and integrating BIM model with GIS environment			
10.	Case study: Life cycle asset management using BIM for a smart building			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative

Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

SEMESTER - VI

Course Code	Course Title
	Design of Steel Structures
	Geotechnical Engineering-I
	Geotechnical Engineering-I Lab
	Irrigation Engineering
	Estimation & Costing
130106117	SEC-IV (Civil Engineering Design Lab)
	Quantitative Aptitude & Logical Reasoning (MCNC)
Program Elective-II Pool (Choose One from the pool)	
	Introduction to Smart Cities
	Digital Image Processing
	Ground Water Engineering
	Advanced Reinforced Concrete Structures
Program Elective-III Pool (Choose One from the pool)	
	Data Visualization
	Urban Transportation Planning
	Waste water treatment
	Design of Tall building
Additional Credits for Specialization Structural Engineering	
	Prestressed Concrete
	Prestressed Concrete Lab
Additional Credits for Specialization Green Technology and Sustainable Engineering	
	Environmental Impact Assessment and Sustainable Planning
	Environmental Impact Assessment and Sustainable Planning Lab
Additional Credits for Specialization Construction Technology	
	Automation and Robotics in Construction
	Automation and Robotics in Construction Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106111
Course Title	**Design of Steel Structure**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Study of BIS Codes i.e. IS: 800-1984, IS: 800-2007 related to design of steel structures. Study of design of different types of connections, simple and built-up beams, laterally supported and unsupported beams. The subject imparts knowledge of design beams and columns under combined stresses. Design simple and built up beams and columns.

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

CO1	Design different type of joints and connections.
CO2	Design of tension, compression members of the steel structures.
CO3	Design of column base and beam of steel structure
CO4	Analyze the plastic design

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P0 12	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	2	1	3	1	2	1	2	3	3	2
CO2	1	2	2	2	1	2	2	3	2	2	2	2	3	3	2
CO3	2	3	3	2	2	3	3	3	3	2	3	2	3	3	2
CO4	1	2	1	2	1	2	1	3	1	2	1	2	3	3	2
Average	1.3	2.3	1.8	2.0	1.3	2.3	1.8	3.0	1.8	2.0	1.8	2.0	3	3	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	1	0	3

Unit	Content	Competencies
1	Define the steel joints and connections and stresses induced in these connections. C1 (Remember) Understand the properties of structural steel and rolled steel sections as per IS specifications, and the concept of factor of safety. C2 (Understand) Apply the principles of limit state design to welded and bolted connections, and understand the design of fillet and butt welds. C3 (Application)	

	Analyze the design aspects of eccentric connections, efficiency of joints, and the utilization of high-tension bolts. C4 (Analysis) Evaluate the interplay between the properties of structural steel, rolled steel sections as per IS specifications, and the factor of safety in the design of connections. C5 (Evaluate)
2	Define the compression member in steel structures and its design phenomenon along with the different theories adapted in designing of compression member. C1 (Remember) Understand the concepts of Net Sectional Area, Permissible Stress, and the design principles for axially loaded tension members and members subjected to axial tension and bending. C2 (Understand) Apply the principles of column design, including the modes of failure, buckling failure according to Euler's Theory, effective length, and slenderness ratio. C3 (Application) Analyze the design principles for compression members and built-up compression members, such as laced and battened columns, as well as the design of column splices. C4 (Analysis) Design the compression member. C6 (Create)
3	Define the Tension member in steel structures and its design phenomenon along with the different theories adapted in designing of compression member. C1 (Remember) Understand the introduction to beams, beam types, section classification, lateral stability of beams, lateral torsional buckling of symmetrical sections, design strength of beams (both laterally supported and unsupported). C2 (Understand) Apply the principles of shear strength and deflection, web buckling, and web crippling in beam design. C3 (Application) Analyze the design of slab bases, gusset bases, and grillage foundations, including their connections with columns. C4 (Analysis) Design the tension member. C6 (Create)
4	Understand the concept plate girders and gantry girder, stiffeners, design of plate girders with or without stiffeners C3 (Application), C4 (Analysis), C6 (Create) Discuss the plastic design, shape factor, load factor, plastic hinge, mechanism C2 (Understand), C3 (Application), C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	7
Problem Based Learning (PBL)	12
Case/Project Based Learning (CBL)	--

Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps **1.** Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	
References:	
	Text Books 1. Design of Steel Structures by N. Subramanian (2012),ISBN No. 978-0-19-567681-5, 8th edition Oxford Publication. **Reference Books** Vajrani V. N., Ratwani M. M. and Mehra H. Design and Analysis of Steel Structures, Oscar Publications. Syal I. C. Design of Steel Structures, Standard Publishers Distributors, New Delhi Ramchandra, Non Linear Analysis of Steel Structures, Standard Publishers Distributors. IS: 800-2007 & Steel Table. 4. Design of Steel Structures by Arya and Ajmani, Nem Chand Brothers Roorkee. 5. Ramachandra, Design of Steel structures, Vol. I & Vol. II, Standard Publishers Distributors

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Geotechnical Engineering-I**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Geotechnical Engineering-I is a course that introduces students to the properties and behavior of soils. The course covers the basic principles of soil mechanics, including soil classification, soil composition, soil permeability, consolidation, shear strength, and slope stability. The laboratory experiments are designed to supplement the theory covered in the course. The experiments cover soil classification, determination of soil properties, and testing of soil behavior under different loading conditions.

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

CO1	Understand the origin of the soil and geological cycle and Apply principles of phase diagram for soil properties and perform basic weight-volume calculations
CO2	Understand basics principles of flow and soil permeability through porous media including different methods, Darcy's Law, and Hydraulic conductivity
CO3	Understand how stresses are transferred through soils and be able to compute both geostatic and induced stresses due to point, line, and area loads.
CO4	Estimate the coefficient of consolidation required for settlement under a given load.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	2		1	2	3	3	3	3	2	2
CO2	3	3	3	1	1	2	3	2	2	3	3	3	3	2	2
CO3	3	3	2	1	2	2	3	3	2	3	3	3	3	2	1
CO4	3	2	2	2	2	2	1	2	3	2	3	3	3	2	1
Average	2.8	2.8	2.5	1.5	1.5	2	1.8	2	2.3	2.8	3	3	3	2	1.5

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content

1	Basic concept of soil formation, classification and compaction (C1. C2); discuss the Major soil deposits of India C2 (Understanding); Demonstrate and Distinguish three phase and two-phase system diagram (C3, C4); Compare different classification systems C4 (Analysis), Weight-volume relations C4 (Analysis); Investigate and examine the index properties (Atterberg's limits) and Theory of compaction (C4, C6)
2	Concept of capillary, permeability and seepage C2 (Understanding); describe the Capillarity in soils and types of soil water C2 (Understanding); Determination of permeability of soils and stratified soils C5 (Evaluate); Application of Darcy's law C3 (Application); differentiate Seepage velocity and Seepage pressure C4 (Analysis); describe Effective stress principle and Quick sand condition C2 (Understanding)
3	Concept of Stress distribution in Soils, compaction C2 (Understanding); investigation of stresses in soils – Boussinesq's and Westergaard theories for point loads, Newmark's influence chart (C5, C6), Compare Contact pressure distribution in sands and clays C4 (Analysis); Compare Standard Proctor compaction test and Modified compaction test C4 (Analysis); weigh the factor affecting compaction and soil properties C5 (Evaluate); discuss the Relative compaction, Field compaction and its control C2 (Understanding)
4	Concept of compressibility and consolidation C2 (Understanding); compare the Primary consolidation with secondary consolidation, normally consolidated soil, over consolidated soil and under consolidated soil C4 (Analysis); classify the settlement and determination (C2; C5); Estimation of settlements -Terzaghi 1-D consolidation theory C5 (Evaluate); test for shear strength C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	28
Practical	--
Seminar/Journal Club	04
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	8
Problem Based Learning (PBL)	5
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	

Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

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1. Dr. K.R. Arora, Soil Mechanics and Foundation Engineering (2011), ISBN No. 81-8014-112-8, Seventh Edition, Standard Publishers Distributors, Delhi.
Reference books
1. Soil Mechanics and Foundation Engineering by Dr. P.N. Modi (ISBN-13: 9788189401306)
2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, Wiley Eastern Ltd., New Delhi, 2016
3. William Powrie, Soil Mechanics: Concepts and Applications, Spon Press.
4. Soil Mechanics and Foundation Engineering by B.N.D. Narsinga Rao, 2015, Wiley India Pvt. Ltd. New Delhi.</td></tr>
</table>

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	B.Tech.
Course Code	130105114
Course Title	**Geotechnical Engineering-I Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The Geotechnical Engineering-I Lab is a course that provides hands-on experience in the testing and analysis of soil properties and behavior. The laboratory experiments are designed to supplement the theory covered in the Soil Mechanics course. The course covers the basic principles of soil mechanics, including soil classification, soil composition, soil permeability, consolidation, shear strength, and slope stability. The laboratory experiments cover soil classification, determination of soil properties, and testing of soil behavior under different loading conditions.
Course Outcomes: At the end of the course students will be able to:	
CO1	Understand the importance of water content test in the field of foundation design in soil
CO2	Analyze how porous the soil is or how many voids it contains
CO3	Classify fine grained soil and calculate activity of clays and toughness index of soil.
CO4	Determine the percentage of different grain sizes contained within a soil
CO5	Understand the soil bearing capacity, stability, and to determine the degree of compaction of the fills.
CO6	Determine maximum dry density and optimum moisture content of soil and analyze the denseness of soil
Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:	

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	2	2		2		2	2	1		1	3	2	2
CO2	3	2		2		1	2	1	1	1	1	1	3	2	2
CO3	3	2	2	2		1	2	2	2	2	2	2	3	2	1
CO4	3	2		2		1	2	1	2	1	1	1	3	2	1
CO5	3	3	3	2	1	2	2	3	2	1	2	3	3	2	2
CO6	3	2	2	2	2	1	2	1	1	1	2	1	3	2	2
Average	3	2.3	1.8	2	0.8	1.3	2	1.8	1.8	1.3	1.8	1.8	3	2	1.67

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Test for determination of Water content by Oven drying method C4 (Analysis)			
2.	Test for determination of specific gravity by pycnometer method C4 (Analysis)			
3.	Test for determination of Liquid & Plastic Limit of soil C4 (Analysis)			
4.	Tests for Grain size analysis of soil sample C4 (Analysis)			
5.	Test for determination of In Situ Density – Core cutter & Sand Replacement C4 (Analysis)			
6.	Demonstration of Standard Proctor Compaction Test and Modified Proctor Compaction Test C3 (Application)			
7.	Demonstration of Permeability Test C3 (Application)			
8.	Shear strength test C4 (Analysis)			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	18
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	**Summative**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓	✓	✓

Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Irrigation Engineering**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	In this course, the students will know the importance of irrigation system in India and water requirement of crops. They will also know the hydraulic design of various irrigation structures such as weir, barrage, cross drainage works, dams, silt ejector and excluder, earth dam, canal falls. They will know the various components of head works and head regulator.

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

CO1	Calculate water requirement related to crops for different seasons in India.
CO2	Do hydraulic design of different components of irrigation projects.
CO3	Learn different types of water storage works.
CO4	Learn to calculate and design flood control devices.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	2	2	1	1	1	1	1	3	2	1
CO2	3	3	3	3	2	1	2	1	2	1	2	1	3	3	1
CO3	3	3	3	3	1	2	1				2		3	2	2
CO4	3	3	3	3	2	3	3	3	2			2	3	3	2
Average	3	3	3	3	2	2	2	2	2	1	2	1	3	2.5	1.5

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies
1	Acquire knowledge about the irrigation requirements in India, including the factors that influence irrigation decisions. Understand the scope of irrigation and its importance in agricultural practices. Learn about soil moisture and its relationship with plant growth. Familiarize yourself with crop water requirements and the factors that affect them. Gain knowledge about	

	irrigation scheduling techniques. Understand the concept of irrigation efficiencies and how they impact water use. Learn about the duty-delta-base period concept and the relationship between these parameters. Explore surface and subsurface irrigation methods and their applications. Understand the importance of irrigation water quality and its impact on crop productivity. C1 (Remember), C2 (Understanding) Apply knowledge of irrigation requirements in India to design and implement appropriate irrigation strategies for different crops and regions. Apply the understanding of soil moisture and plant growth to optimize irrigation scheduling and water management. Apply knowledge of crop water requirements to estimate and allocate water resources effectively. Apply principles of irrigation efficiencies to enhance water-use efficiency and crop productivity. Apply the duty-delta-base period concept in designing irrigation systems and determining water supply. Apply knowledge of surface and subsurface irrigation methods to select the appropriate irrigation technique for specific soil and crop conditions. Apply knowledge of irrigation water quality to assess and manage water resources for sustainable crop production. C3 (Application)
2	Acquire knowledge about the introduction to diversion headworks and their significance in water resource management. Understand the layout and components of a diversion headwork structure. Learn about Khosla's theory and the concept of a flow net in hydraulic engineering. Gain an understanding of the safe exit gradient concept and its importance in preventing soil erosion. Familiarize yourself with the hydraulic design principles of weirs based on Bligh's theory. Learn about the design of modern barrages using Khosla's theory. Understand the necessity and functioning of silt excluders and silt extractors in water diversion structures. C1 (Remember), C2 (Understanding) Apply knowledge of diversion headwork components to design layouts for specific water diversion projects. Apply Khosla's theory and the concept of flow nets to analyze seepage and hydraulic behavior in diversion headworks. Apply the concept of safe exit gradient to determine appropriate measures for soil erosion prevention. Apply hydraulic design principles based on Bligh's theory to design weirs for efficient water flow control. Apply Khosla's theory to the design of modern barrages for effective water diversion and storage. Apply knowledge of silt excluders and silt extractors to design appropriate systems for sediment removal in diversion headworks. C3 (Application) Evaluate the performance and functionality of weirs and barrages designed based on hydraulic principles. C5 (Evaluate) Design innovative diversion headwork layouts and component arrangements that optimize water diversion efficiency and minimize environmental impacts. C6 (Create)
3	Acquire knowledge about the classification and selection criteria of cross drainage works in hydraulic engineering. Understand the hydraulic design aspects of aqueducts and syphon aqueducts. Learn about the necessity and

	classification of canal falls. Gain an understanding of the hydraulic design principles of Sarda type and Straight Glacis falls. C1 (Remember), C2 (Understanding) Analyze the classification criteria and selection process of cross drainage works to determine the most suitable structures for different hydraulic scenarios. Analyze the hydraulic design aspects of aqueducts and syphon aqueducts to ensure their functionality and efficiency. Analyze the necessity of canal falls and their classification to optimize water flow control in canal systems. Analyze the hydraulic design principles of Sarda type and Straight Glacis falls to ensure effective energy dissipation and water flow regulation. C4 (Analysis) Design Sarda type and Straight Glacis falls to enhance their hydraulic performance. C6 (Create)
4	Acquire knowledge about the necessity and classification of dams. Understand the factors involved in the selection of a suitable dam site. Learn about the basic concepts and principles of gravity dams, earth dams, spillways, and their hydraulic design. C1 (Remember), C2 (Understanding) Apply knowledge of dam necessity and classification to select an appropriate dam type for specific purposes. Apply site selection criteria to identify suitable locations for dam construction. Apply hydraulic design principles to design gravity dams, earth dams, and spillways. Apply knowledge of seepage control and filter design to ensure the stability and safety of earth dams. C3 (Application) Analyze the necessity of dams and their classification to determine the most suitable dam type for specific applications. Analyze site selection factors to assess the feasibility and suitability of potential dam sites. Analyze the forces acting on gravity dams and evaluate their stability based on the established criteria. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	

Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. Irrigation Engineering and Hydraulic Structures (2011) 24th edition, ISBN No. 81-7409-047-9, S.K. Garg, Khanna Publications. **Reference books** 1. Viessmen, Jr. & Lewis, Introduction to Hydrology, PHI Learning Private Ltd. 2. Agarwal, V.C. Groundwater Hydrology. PHI Learning Private Ltd. 3. Larry W. Mays, Water Resources Engineering. Wiley Publications. 4. Subramanya, K., Engineering Hydrology, Tata McGraw-Hill.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Estimation & Costing**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course provides a comprehensive understanding of estimation and costing principles in construction projects. Topics covered include quantity surveying, cost estimation methods, pricing of materials and labor, and preparation of project budgets. Students will learn how to interpret construction drawings, quantify materials, and calculate project costs. The syllabus also includes an introduction to computer-aided estimation software. Practical exercises and case studies will enhance students' skills in accurate cost estimation and budgeting. By the end of the course, students will be proficient in preparing detailed project estimates and managing costs effectively in construction projects.

Course Outcomes: At the end of the course students will be able to:	
CO1	Forecast the approximate cost of the projects through preliminary and detailed estimates.
CO2	Analyze the rates of individual items for the preparation of the estimates.
CO3	To record measurements of the finished products for the calculation of length, area, volume for payment purpose.
CO4	Prepare schedule of quantities required to be attached with the tender documents.
Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:	

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	2	2
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	2	3
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	2	2
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	2	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2.25

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**

<table>
<tr><th>3</th><th>0</th><th>0</th><th>3</th></tr>
<tr><th>Unit</th><th colspan="2">Content</th><th>Competencies</th></tr>
<tr><td>1</td><td colspan="3">Acquire knowledge about the principles of estimation, including units of measurement and item work. Understand the different types of estimates and the methods used in estimation. Learn about the estimation of materials for various building components, such as walls, foundations, floors, roofs, and R.B (Random Rubble) and R.C.C (Reinforced Cement Concrete) works. Gain knowledge about estimating quantities for plastering, whitewashing, distempering, painting, doors, windows, lump sum items, and canals. C1 (Remember), C2 (Understanding)
Apply knowledge of estimation principles and methods to accurately estimate quantities of materials for different types of construction projects. Apply estimation techniques to calculate material requirements for walls, foundations, floors, roofs, R.B and R.C.C works, plastering, whitewashing, distempering, painting, doors, windows, lump sum items, and canals. C3 (Application)
Prepare the estimate for building and canal. C6 (Create)</td></tr>
<tr><td>2</td><td colspan="3">Acquire knowledge about the necessity of specifications in construction projects. Understand the different types of specifications, including general specifications and detailed specifications for various construction activities. Learn about the specific requirements and standards for bricks, cement, sand, water, lime, reinforcement, and other construction materials. Gain knowledge about detailed specifications for earthwork, cement, concrete, brickwork, flooring, D.P.C (Damp Proof Course), R.C.C (Reinforced Cement Concrete), cement plastering, white and color washing, distempering, and painting. C1 (Remember), C2 (Understanding)
Apply knowledge of specification requirements to select appropriate materials and methods for construction projects. Apply detailed specifications to ensure the correct proportions, techniques, and quality of construction activities. Apply general specifications to maintain consistency and compliance throughout the construction process. C3 (Application)</td></tr>
<tr><td>3</td><td colspan="3">Acquire knowledge about the purpose, importance, and requirements of rate analysis in construction projects. Understand the units of measurement used in rate analysis and the process of preparing rate analysis. Learn about the procedure of rate analysis for various construction items, including earthwork, concrete works, R.C.C works, reinforced brickwork, plastering, painting, and finishing activities such as white washing and distempering. C1 (Remember), C2 (Understanding)
Apply knowledge of rate analysis purpose and requirements to conduct accurate cost estimation for construction projects. Apply the appropriate units of measurement in rate analysis calculations. Apply the procedure of rate analysis to determine the costs of different construction items, including earthwork, concrete works, R.C.C works, reinforced brickwork, plastering, painting, and finishing activities. C3 (Application)</td></tr>
</table>

4	Acquire knowledge about the tendering process and the acceptance of tenders in construction projects. Understand the concepts of earnest money, security money, and retention money. Learn about the importance and usage of measurement books and cash books in project management. Gain knowledge about the preparation, examination, and payment of bills, including first and final bills. Understand the significance of administrative sanction and technical sanction in construction projects. C1 (Remember), C2 (Understanding) Apply knowledge of tendering, billing, and valuation concepts to participate in the tendering process and prepare tender documents. Apply the principles of valuation to assess the worth of buildings and determine financial aspects. Apply measurement book and cash book management techniques for accurate recording and payment of bills. Apply the procedures for preparation and examination of bills and processing payments to contractors. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

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Reference Books
1. Chakraborty, Estimate costing &specification in Civil Engineering.
2. Kohli & Kohli, Atext book on estimating &costing (Civil) with drawings Ambala Ramesh Publications
3. Rangwala SC Estimating &Costing, Anand Charotar Book Stall.</td></tr>
</table>

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106117
Course Title	**Civil Engineering Design Lab**
Academic Year	III
Semester	VI
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	This lab-based course is designed to familiarize students with the structural analysis and design software, STAAD PRO. The syllabus covers topics such as structural modeling, load calculations, and analysis of various structural elements such as beams, columns, and trusses. Students will learn to apply design codes and standards to ensure structural safety and efficiency. The course emphasizes hands-on experience through practical exercises and projects, allowing students to develop proficiency in using STAAD PRO for structural analysis and design.

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

CO1	Independently carry out research / investigation and development work to solve practical problems.
CO2	Capable to apply the core, multidisciplinary knowledge for understanding the problems in structural engineering and allied fields.
CO3	Identify and analyze the impact of Structural Engineering in development projects and find a suitable solution from number of alternatives.
CO4	Conceptualize and design civil engineering structures considering various socioeconomic factors.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	2	3	1	1	2	3	3	1	2
CO2	1	3	2	1	2	2	1	2	2	3	2	1	3	2	1
CO3	2	3	3	3	3	3	1	2	3	3	1	1	3	2	1
CO4	3	3	2	3	2	3	2	1	1	2	1	1	3	3	2
Average	2.25	3	2.25	2.25	2	2.5	1.5	2	1.75	2.25	1.5	1.5	3	2	1.5

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	4	4

Experiment No.	Content	Competencies

1.	Introduction to STAAD Pro. Environment C2 (Understand), C3 (Application)
2.	Model Generation C6 (Create)
3.	Loading Condition C3 (Application)
4.	Loading Combination C3 (Application)
5.	Two-Dimensional Portal frame under vertical and horizontal loads C4 (Analyze)
6.	Analysis of Simply Supported beam C4 (Analyze)
7.	Analysis of Cantilever beam C4 (Analyze)
8.	Analysis of Continuous beam C4 (Analyze)
9.	Truss Analysis C4 (Analyze)
10.	Roof Truss Analysis C4 (Analyze)
11.	Case study C5 (Evaluate)
12.	Introduction to E Layer C2 (Understand), C3 (Application)
13.	Single Layer Analysis C4 (Analyze)
14.	Double Layer Analysis C4 (Analyze)
15.	Multi-Layer Analysis C4 (Analyze)
16.	Introduction to IIT PAVE C2 (Understand), C3 (Application)
17.	Design of Flexible Pavement (Deflection Criteria) C6 (Create)
18.	Design of Flexible Pavement (Rutting Criteria) C6 (Create)
19.	Design of Flexible Pavement (Thickness Determination) C6 (Create)
20.	Introduction to IIT RIGID C2 (Understand), C3 (Application)
21.	Design of Rigid Pavement (Critical Stress) C6 (Create)
22.	Design of Rigid Pavement (Slab Thickness) C6 (Create)
23.	Design of Rigid Pavement (Dowel bar) C6 (Create)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	15
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	25
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	**Summative**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce

Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps
1. Regular feedback through Mentor Mentee system
2. **Feedback between the semester through google forms**

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	Quantitative Aptitude & Logical Reasoning
Academic Year	III
Semester	VI
Number of Credits	NIL
Course Prerequisite	Basic Mathematics at 10+2 Level
Course Synopsis	This course aims to enhance the quantitative aptitude and logical reasoning skills of engineering students to prepare them for placement exams, competitive tests, and industry assessments. It covers fundamental mathematical concepts and develops problem-solving techniques with a focus on numerical ability, analytical reasoning, and data interpretation. The course trains students to approach problems with logical rigor, speed, and accuracy, making them industry-ready and competitive exam-prepared.

Course Outcomes:

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

CO1	Solve problems involving basic arithmetic, algebra, percentages, and averages.
CO2	Apply logical reasoning techniques for analytical and verbal reasoning problems.
CO3	Interpret and analyze data for decision making in quantitative scenarios.
CO4	Develop speed and accuracy in solving aptitude and reasoning-based questions under time constraints.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)& Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	2	1	1	1	1	1	2	2	2	1	-
CO2	3	2	2	2	2	1	1	1	1	1	2	2	2	1	-
CO3	3	3	3	2	3	1	1	1	1	2	2	2	2	2	-
CO4	3	2	2	2	3	1	1	1	2	2	2	2	2	2	1
Average	3	2.25	2.25	2	2.5	1	1	1	1.25	1.5	2	2	2	1.5	0.5

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
2	**0**	**0**	**2**

Unit	**Content & Competencies**
1	**Number System and Arithmetic (C2)** • Number Series, Divisibility Rules, LCM and HCF, Simplification • Ratio and Proportion, Averages, Percentages, Profit and Loss • Time, Speed and Distance, Time and Work • Mixtures and Alligation, Simple and Compound Interest
2	**Algebra, Geometry and Data Interpretation (C3)** • Basic Algebra: Linear and Quadratic Equations, Inequalities • Geometry: Lines, Angles, Triangles, Circles, Mensuration • Data Interpretation: Bar Graphs, Pie Charts, Tables, Line Graphs • Practice on interpreting numerical and graphical data sets
3	**Logical Reasoning – Analytical and Verbal (C3)** • Series, Coding-Decoding, Blood Relations, Directions • Syllogism, Statements and Assumptions, Statements and Conclusions • Logical Venn Diagrams, Ranking, Seating Arrangements • Puzzles and Logical Deductions
4	**Advanced Aptitude and Strategy (C4)** • Calendars, Clocks, Cubes, Binary Logic • Caselets and Advanced Data Interpretation • Tips and Tricks for Time Management in Competitive Exams • Mock Test-Based Practice, Test Analysis, Strategy Building

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	15
Practical	--
Seminar/Journal Club	--
Small Group Discussion (SGD)	5

Self-Directed Learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	5
Case/Project Based Learning (CBL)	5
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Assignments	Mid Semester Examination 2 (Mid Term 3 is optional)
Student Seminar	University End Term Examination
Problem Based Learning (PBL)	Project

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Assignment / Presentation	✓	✓	✓	✓
Mid Semester Examination 1	✓	✓	✓	✓
Mid Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback 2. Course Exit Survey

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system.
2. Feedback between the semester through google forms.
3. Course Exit Survey will be taken at the end of semester.

References:	(List of reference books)
	i) R.S. Aggarwal, *Quantitative Aptitude for Competitive Examinations*, S. Chand Publications, Latest Edition,**ISBN**: 9789355015409 **ii)** Arun Sharma, *How to Prepare for Quantitative Aptitude for CAT*, McGraw-Hill Education, **ISBN**: 9789354600354 **iii)** Nishit Sinha, *Logical Reasoning and Data Interpretation for CAT*, Pearson Education, **ISBN**: 9789356064346

	iv) Dr. R.S. Aggarwal, *A Modern Approach to Logical Reasoning*, S. Chand Publications, **ISBN**: 9789355016438 **v)** Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, Tata McGraw-Hill, **ISBN**: 9789353160195

Program Elective - II

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106121
Course Title	**Introduction to Smart Cities**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	The course "Introduction to Smart Cities" provides students with a comprehensive understanding of the concept of smart cities and their potential to address urban challenges through the integration of technology, data, and sustainable practices. The course explores various aspects of smart cities, including smart governance, infrastructure, mobility, energy, and sustainability. Students will learn about the key components of smart cities, emerging technologies and innovations, data analytics, and citizen engagement. The course aims to equip students with the knowledge and skills to contribute to the development and implementation of smart city initiatives.

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

CO1	Understand the concept and evolution of smart cities.
CO2	Identify the key components and systems that make up smart cities.
CO3	Analyze the benefits and challenges of implementing smart city technologies and solutions.
CO4	Explain the role of technology, data, and connectivity in smart city development.
CO5	Understand the principles of urban planning and design in the context of smart cities.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2			2			3		3	2	1
CO2	3	3	2	2	2			2			3		3	2	1
CO3	3	3	2	2	2			2					3	2	1
CO4	3	3	3	3	2			2			2		3	2	
CO5	3	3	3	3	2			2			2		3	2	
Average	3	3	2.5	2.2	2			2			2		3	2	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Acquire knowledge about smart cities, including their definition and characteristics. Understand the evolution and global trends in smart city development, including the technologies and innovations driving their growth. Learn about the benefits that smart cities can bring, as well as the challenges they may face. Familiarize yourself with smart city frameworks and models that provide a structured approach to their planning and implementation. Understand the concepts of digital governance and e-government services in the context of smart cities. Gain knowledge about open data and transparency practices in smart cities. Learn about citizen participation and co-creation approaches that involve residents in smart city initiatives. Understand the importance of privacy and data security considerations in the implementation of smart city projects. C1 (Remember), C2 (Understanding) Apply smart city frameworks and models to develop comprehensive plans for smart city initiatives. Apply digital governance practices and e-government services to improve public service delivery and citizen engagement in smart city projects. Apply open data principles to make data available for analysis and innovation. Apply citizen participation and co-creation strategies to involve residents in smart city decision-making processes. Apply privacy and data security measures to protect personal information in smart city operations. C3 (Application)	
2	Acquire knowledge about intelligent transportation systems (ITS) and their role in smart cities. Understand the concept of smart buildings and infrastructure and how they contribute to sustainability. Learn about water and waste management strategies in smart cities. Familiarize yourself with sustainable urban planning and design principles. Gain knowledge about connected and autonomous vehicles (CAVs) and their integration into transportation systems. Learn about multi-modal transportation solutions that promote efficient and sustainable mobility. Understand the importance of traffic management and congestion reduction in smart cities. C1 (Remember), C2 (Understanding) Apply intelligent transportation system (ITS) technologies to design and implement transportation solutions in smart cities. Apply smart building and infrastructure concepts to enhance energy efficiency and automation in building design and operation. Apply water and waste management strategies to promote sustainable resource use and waste reduction in urban areas. Apply sustainable urban planning and design principles to create environmentally friendly and livable cities. Apply connected and autonomous vehicle (CAV) technologies to develop efficient and safe transportation systems. Apply multi-modal transportation solutions to improve accessibility and mobility in urban areas. Apply traffic management strategies to reduce congestion and enhance traffic flow. C3 (Application)	

3	Acquire knowledge about energy-efficient systems and their integration with renewable energy sources. Understand the concept of smart grids and their role in energy management. Learn about demand response strategies and energy conservation techniques. Familiarize yourself with sustainable urban energy planning principles. Gain knowledge about the Internet of Things (IoT) and sensor networks in the context of smart cities. Learn about big data analytics and machine learning applications in urban energy systems. Understand the role of artificial intelligence (AI) and predictive analytics in optimizing energy efficiency. Learn about blockchain technology and its potential applications in smart city energy systems. C1 (Remember), C2 (Understanding) Apply knowledge of energy-efficient systems and renewable energy integration to design and implement sustainable energy solutions in smart cities. Apply smart grid concepts to optimize energy distribution and management. Apply demand response strategies and energy conservation techniques in real-world scenarios. Apply sustainable urban energy planning principles to develop energy-efficient urban development plans. Apply IoT and sensor networks to monitor and control energy systems. Apply big data analytics and machine learning algorithms to analyze energy data and optimize energy consumption. Apply AI and predictive analytics to automate energy management processes. Apply blockchain technology in energy transactions and decentralized energy systems. C3 (Application)
4	Acquire knowledge about the relationship between sustainable development goals and smart cities. Understand the concepts of climate change adaptation and mitigation and their relevance to smart city development. Learn about resilience planning and disaster management strategies in the context of smart cities. Familiarize yourself with the principles of circular economy and waste management in urban environments. Analyze successful smart city projects and their impact on sustainability. Explore international comparisons and benchmarking to understand global trends in smart city development. Understand the social and ethical considerations associated with smart city initiatives. Gain knowledge about the economic and policy challenges involved in implementing smart city projects. Explore future directions and opportunities for the development of smart cities. C1 (Remember), C2 (Understanding) Apply the knowledge of sustainable development goals to design smart city projects that align with the SDGs. Apply climate change adaptation and mitigation strategies to develop resilient smart city plans. Apply circular economy principles to design waste management systems within smart cities. Apply the analysis of successful smart city projects to inform the design and implementation of new projects. Apply international comparisons and benchmarking to identify best practices for smart city development. Apply social and ethical considerations in the design and implementation of smart city technologies. Apply economic and policy

	frameworks to address challenges and support the implementation of smart city projects. Apply future-oriented thinking to identify opportunities and innovative approaches for smart city development. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5
Peer Group activities	✓	✓	✓	✓	✓
Quiz	✓	✓	✓	✓	✓
Seminars	✓	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

References:	
	Text Books Introduction to smart cities, by Anil Kumar, Pearson Publication. **Reference Books** 1. Smart Cities - Big Data, Civic Hackers, and the Quest for a New Utopia 2. The Smart Enough City: Putting Technology in Its Place to Reclaim Our Urban Future (Strong Ideas), Ben Green

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology in Civil Engineering
Course Code	
Course Title	Digital Image Processing
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	Digital Image Processing
Course Synopsis	Digital image processing includes Introduction Image processing system, Image Analysis and Understanding and Multi temporal Data merging – Change detection procedures & Hyper-spectral Image Analysis and Radar image analysis.

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

CO1	Students will be able to understand use of image processing in Civil Engineering
CO2	Students will understand about GIS and image processing techniques
CO3	study and analyze the image processing
CO4	analyze the appropriate methods to improve data merging and image analysis

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	2	2			2			3		3	2	1
CO2	3	3	2	2	2			2			3		3	2	1
CO3	3	3	2	2	2			2					3	2	1
CO4	3	3	3	3	2			2			2		3	2	
Average	3	3	2.5	2.2	2			2			2		3	2	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**1**	**0**	**4**

Unit	Content
1	Image processing system; Satellite data acquisition –Storage and retrieval – Data Formats – Compression – Satellite System (C1, Remember); Data products – Image display system – Current Remote Sensing Systems. Preprocessing of remotely sensed data; (C2, Understand); Radiometric and Geometric distortions and corrections- Geometric correction Radiometric correction – Noise removal. Spectral Rationing –Principal and Canonical Components– Vegetative Components. (C1, Remember, C4, Analyzed)
2	Image Rectification and Restoration. Image enhancement- Contrast Manipulation – Gray-Level (C2, Understand, C4, Analyzed); Thresh holding- Level Slicing Contrast Stretching. Convolution – Edge Enhancement – Spatial feature manipulation. Image transformations; Pattern recognition, Image classification, Image fusion and change detection. Pattern recognition – Shape analysis- Textural and contextual analysis. (C6,Create);
3	Multi temporal Data merging – Change detection procedures- Multi sensor image merging – Merging of image data with Ancillary data Incorporating GIS Data in automated land cover classification. (C2,Understand, C4,Analyzed), (C6,Create);
4	Atmospheric correction – Hyper-spectral image analysis techniques.(C1, Remember), (C4, Analyzed)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	30
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	4
Self-directed learning (SDL) / Tutorial	8
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	3
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4

Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1.Regular feedback through Mentor Mentee system 2.Feedback between the semester through google forms	
References:	
	Text Books: 1. John R Jenson „Introducing Digital Image Processing" Prantice Hall. New Jersy 1986. 2. R. A. Schowengergt, „Techniques for Image Processing and Classification in Remote Sensing'; 1983 **Reference Books:** 1. Remote Sensing & Image Interpretation Thomas M. Lillesand, Ralph W.Kiefer, 2. Image Interpretation in Geology Drury S.A. 3. Robert A Schowengergt, „Remote Sensing – Models and Methods for Image Processing¬ Academic Press 1997 Hord R M, Academic Press, 1982.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Ground water engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	
Course Synopsis	This course covers fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater. Introduction and definitions, groundwater storage and supply, Darcy's Law and its limitation, Dupuit approximation, steady and unsteady flows in confined and unconfined aquifers, radial flow towards wells, storage coefficient and safe yield in a water-table aquifer, design of wells, methods of drilling and construction, development of maintenance of wells.

Course Outcomes:

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

CO1	Identify the ground water flow & prediction.
CO2	Implement the Methods of improving the ground water potential.
CO3	Manage the ground water sources.
CO4	Develop and implement sustainable groundwater management strategies.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P01 2	PSO 1	PSO 2	PSO 3
CO1	2	3	3	3	3	3	1	2	3	3	1	1	3	2	1
CO2	3	1	1	2	1	2	2	3	1	1	2	3	3	2	1
CO3	2	2	3	1	2	2	1	2	2	3	2	1	3	2	1
CO4	3	1	1	2	3	2	2	3	1	1	2	3	3	2	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	1

<table>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Course Content:</td></tr>
<tr><th colspan="2">L (Hours/Week)</th><th>T (Hours/Week)</th><th>P (Hours/Week)</th><th colspan="2">Total Hour/Week</th></tr>
<tr><td colspan="2">3</td><td>0</td><td>0</td><td colspan="2">3</td></tr>
<tr><th>Unit</th><th colspan="4">Content</th><th>Competencies</th></tr>
<tr><td>1</td><td colspan="5">Hydrologic cycle, including its components and processes, origin and age of groundwater, the classification of groundwater, aquifers, the water table, Darcy's Law, the coefficient of transmissibility and storage, flow rates, and the relevant equations. C1 (Remember), C2 (Understanding)

Principles of the hydrologic cycle, groundwater classification, aquifers, the water table, Darcy's Law, and flow rate equations to analyze and interpret groundwater systems. Apply the concepts to solve problems related to groundwater flow and aquifer characteristics. C3 (Application)</td></tr>
<tr><td>2</td><td colspan="5">Acquire knowledge about geophysical methods used in groundwater exploration and characterization. Understand the principles and techniques of radial flow and well flow analysis. Familiarize yourself with the concepts of multiple well systems, characteristic well losses, and various types of wells, including open wells and tube wells. Learn about well depth, well screen design, and the factors influencing head losses through screens. Gain an understanding of gravel packing and formation stabilization techniques. C1 (Remember), C2 (Understanding)

Apply geophysical methods to assess groundwater potential and characterize subsurface conditions. Apply radial flow and well flow analysis techniques to interpret pumping test data. Apply knowledge of well types, depth, and screen design to optimize well performance. Apply techniques for gravel packing and formation stabilization in well construction. C3 (Application)</td></tr>
<tr><td>3</td><td colspan="5">Groundwater pumping tests. Understand the definitions of static water level, pumping level, drawdown, residual drawdown, and drawdown pumping rate. Familiarize yourself with the use of automatic water level recorders and the principles behind time drawdown analysis and distance drawdown analysis. Learn about Jacob's methods and different pumping test methods. C1 (Remember), C2 (Understanding)

Apply knowledge of key terms and concepts to interpret groundwater pumping test data. Apply the use of automatic water level recorders to gather accurate and reliable water level measurements. Apply time drawdown analysis techniques to analyze and interpret drawdown data obtained during pumping tests. Apply distance drawdown analysis methods, including Jacob's analysis, to estimate aquifer parameters based on distance drawdown curves. C3 (Application)</td></tr>
</table>

4	Acquire knowledge about various injection methods and monitoring techniques used in ground improvement. Understand the principles and applications of cement lime, lime-fly ash, and chemical stabilization. Learn about deep mixing techniques and their effectiveness in improving soil properties. Gain knowledge about the hydrological equilibrium and its importance in groundwater management. Understand the concept of a rain gauge network and its role in monitoring rainfall. Learn about the procedures for conducting infiltration tests and the calculation of groundwater storage capacity and potential. Familiarize yourself with artificial recharge methods and rainwater harvesting techniques. C1 (Remember), C2 (Understanding) Apply knowledge of different injection methods and monitoring techniques to select appropriate ground improvement methods for specific soil conditions. Apply deep mixing techniques to enhance soil properties and improve ground stability. Apply the principles of hydrological equilibrium to assess groundwater resources and develop sustainable water management strategies. Apply the knowledge of rain gauge networks to establish monitoring systems for rainfall data collection. Apply infiltration testing procedures to evaluate soil infiltration capacity and assess groundwater recharge potential. Apply calculations and estimation methods to determine groundwater storage capacity and potential. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	

Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	(List of books)
	Text Books Raghunath H.M. (2007), Groundwater, Third Edition, ISBN No. 978-81-224-1904-7, New Age **Reference Books** 1.David Keith Todd (2005), Groundwater Hydrology, Third Edition, John Wiley & Sons 2.Abdel-Aziz ismail kashef (2008), Groundwater Engineering, McGraw-Hill International Editions, New york

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Advanced Reinforced Concrete Structures**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Course contains learning of concept of working stress method and limit state method for various reinforced concrete sections. It includes concept of design of one way, two way and circular slabs, short column and long column, axially and eccentrically loaded columns. Students will understand the concept of footings and retaining wall design as well.

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

CO1	Understand the behavior and load-carrying capacity of advanced reinforced concrete structural elements.
CO2	Apply advanced analysis techniques to determine the internal forces and deflections in reinforced concrete structures.
CO3	Design Flat slab, Domes, beams, beams curved in plan, water tanks, bunker, silos, chimney R.C.C structures on their own.
CO4	Use relevant BIS codes related to above mentioned R.C.C structures respectively.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	2	2			2			3		3	2	1
CO2	3	3	2	2	2			2			3		3	2	1
CO3	3	3	2	2	2			2					3	3	2
CO4	3	3	3	3	2			2			2		3	2	1
Average	3	3	2.5	2.25	2			2			2		3	2.25	1.25

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Gain an understanding of the introduction to flat slab and its components. Learn about the design methods of flat slab, including the direct method and	

	equivalent frame method based on IS: 456-2000. Acquire knowledge about handling openings in flat slab and the detailing of reinforcement. C2 (Understanding) Apply the design methods and provisions of IS: 456-2000 to design flat slabs using the direct method and equivalent frame method. Apply the principles and guidelines for handling openings in flat slabs and detailing reinforcement. Apply the design principles and analysis techniques for beams curved in plan, considering different support conditions and torsional effects. C3 (Application) Analyze the advantages and components of flat slab construction. Analyze the differences between the direct method and the equivalent frame method for designing flat slabs. Analyze the considerations and techniques for incorporating openings in flat slabs. Analyze the design and analysis of beams curved in plan, including the determination of torsion factors and required reinforcement. C4 (Analysis)
2	Gain an understanding of the introduction to domes, circular tanks, and rectangular tanks. Learn about the stresses in spherical domes due to static and wind loads, as well as the design principles of RCC spherical domes. Acquire knowledge about the general design requirements for circular tanks according to IS: 3370-II. Understand the different types of joints in water tanks, including flexible joints between the floor and wall and rigid joints between the floor and wall. Learn about the IS code provisions for circular tanks. Familiarize yourself with the approximate and exact methods for the design of rectangular tanks. Understand the principles of design for underground tanks, including the calculation of earth pressure and uplift pressure on the wall and floor. C2 (Understanding) Apply the principles of stress analysis to determine the stresses in spherical domes due to static and wind loads. Apply the design principles specified by IS: 3370-II to meet the general design requirements for circular tanks. Apply the appropriate joint design techniques for water tanks, considering flexible and rigid connections. Apply the relevant provisions and guidelines outlined in IS codes for circular tanks. Apply the approximate and exact methods for the design of rectangular tanks. Apply the principles of earth pressure and uplift pressure to design underground tanks. C3 (Application) Analyze the factors affecting the stresses in spherical domes, including static and wind loads. Analyze the design requirements and considerations for circular tanks according to IS: 3370-II. Analyze the implications and performance of different joint types in water tanks. Analyze the provisions and requirements specified in IS codes for circular tanks. Analyze the differences and limitations of the approximate and exact methods for designing rectangular tanks. Analyze the factors influencing the earth pressure and uplift pressure on the walls and floor of underground tanks. C4 (Analysis) Evaluate the effectiveness of the design of RCC spherical domes based on the calculated stresses and load-bearing capacity. Evaluate the compliance of circular tanks with the design requirements specified in IS: 3370-II.

	Evaluate the performance and suitability of different joint designs in water tanks based on their ability to provide watertightness and structural integrity. Evaluate the conformity of circular tanks with the provisions outlined in relevant IS codes. Evaluate the accuracy and reliability of the approximate and exact methods used in the design of rectangular tanks. Evaluate the stability and structural integrity of underground tanks based on the calculated earth pressure and uplift pressure. C5 (Evaluate) Design of dome and water tank. C6 (Create)
3	Acquire an understanding of the introduction to bunkers, conical hoppers, and pyramidal hoppers. Learn about Janssen's theory and Airy's theory, which are relevant to the design of such structures. C2 (Understanding) Apply Janssen's theory and Airy's theory to analyze the pressure distribution, stresses, and displacements in bunkers, conical hoppers, and pyramidal hoppers. Apply the design principles and guidelines to develop efficient and safe bunker designs. Apply structural analysis techniques to design conical and pyramidal hoppers with appropriate dimensions and angles. C3 (Application) Analyze the behavior of granular materials stored in bunkers, conical hoppers, and pyramidal hoppers using Janssen's theory and Airy's theory. Analyze the pressure distribution, stresses, and displacements to ensure the structural integrity and stability of these structures. Analyze the flow characteristics of the stored material to determine the optimal dimensions and angles for efficient discharge. Analyze the load-bearing capacity and performance of structural elements in bunkers, conical hoppers, and pyramidal hoppers. C4 (Analysis) Evaluate the effectiveness of Janssen's theory and Airy's theory in predicting the pressure distribution, stresses, and displacements in bunkers, conical hoppers, and pyramidal hoppers. Evaluate the compliance of bunker designs with the specified design principles and guidelines. Evaluate the efficiency and reliability of conical and pyramidal hopper designs in facilitating material flow and preventing blockages. C5 (Evaluate) Design of Bunkers and hoppers. C6 (Create)
4	Gain an understanding of the basic concepts of prestressed concrete, its advantages, and the materials required for prestressing. Learn about different systems and methods used in prestressing. Acquire knowledge of section analysis, stress concept, strength concept, load balancing concept, and the effects of loading on tensile stresses in tendons. Understand the factors influencing deflections, calculation of deflections, short-term and long-term deflections, losses of prestress, and estimation of crack width. C2 (Understanding) Apply the concepts of prestressed concrete to analyze and design prestressed members. Apply different systems and methods of prestressing based on project requirements. Apply section analysis techniques to determine the stress distribution and structural behavior. Apply load balancing techniques to optimize the design and reduce tensile stresses. Apply deflection calculations and consider factors influencing deflections in the design

	process. Apply methods to estimate crack widths and ensure structural durability. C3 (Application) Analyze the behavior of prestressed concrete members under applied loads and prestressing forces. Analyze stress distribution, strength capacity, and load balancing in prestressed sections. Analyze the effects of loading on tensile stresses in tendons. Analyze the influence of tendon profiles on deflections. Analyze the factors influencing deflections and calculate short-term and long-term deflections. Analyze the losses of prestress and their impact on the structural response. Analyze crack widths and assess their implications for structural durability. C4 (Analysis) Evaluate the effectiveness of prestressing concepts, systems, and methods in enhancing the performance of concrete structures. Evaluate the compliance of prestressed concrete designs with relevant codes and standards. Evaluate the accuracy of deflection calculations and crack width estimations. Evaluate the safety, efficiency, and durability of prestressed concrete members. C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

<table>
<tr><td colspan="2">Feedback Process</td><td>1. Student’s Feedback</td></tr>
<tr><td colspan="3">Students Feedback is taken through various steps
1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms</td></tr>
<tr><td>References:</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2"><u>Text Books</u>
R.C.C Designs by B.C. Punmia and A.K. Jain, Laxmi Publication.
<u>Reference Books</u>
1. Design of Reinforced Concrete Structures, P.Dayaratnam, Oxford& IBH Publication New Delhi.</td></tr>
</table>

Program Elective - III

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107122
Course Title	**Data Visualization**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	A Course on "Data Analysis using Python"
Course Synopsis	The objective of this course is to teach students the concepts of Data Visualization

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

CO1	Build data models and manage and manipulate data to extract useful information and insights
CO2	Apply functions to manipulate and analyze data
CO3	Discover customer preference, purchasing habits, and other behaviors
CO4	Make use of Tableau software for data visualization

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	**Content**	**Competencies**
1	Illustrate Data Handling. (C3, Application), Explain Data analysis. (C2, Comprehension), Define Data visualization. (C1, Knowledge), Facilitate statistical formulas (C6, Evaluation), Infer Logical and financial functions. (C4, Analysis)	
2	Explain Power BI Analytics. (C2, Comprehension), Explain Data Validation & data models. (C2, Comprehension), Demonstrate Power Map for visualize data (C3, Application), Evaluate Power BI-Business. (C6, Evaluation), Solve Data Analysis using statistical methods (C3, Application), Explain Dashboard designing. (C2, Comprehension)	

3	Relate Data Manipulation using Function. (C4: Analysis), Construct Heat Map, Tree Map, Smart Chart. (C3, Application), Analyze Azure Machine learning. (C4: Analysis), Construct Column Chart, Line Chart. (C3: Application), Illustrate Pie, Bar, Area, Scatter Chart (C3, Application), Demonstrate Data Series, Axes, Chart Sheet, Trendline (C3, Application)
4	1. Assess Gantt Chart, Pareto Chart. (C6, Evaluation), Diagram Frequency Distribution (C4, Analysis), Practice Pivot Chart, Slicers (C3, Application), Demonstrate Create References, Table Styles (C3: Application), Judge What-If Analysis (C6, Evaluation), Design Correlation model (C5, Synthesis), Explain Regression model (C1. Knowledge)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	21
Practical	--
Seminar/Journal Club	04
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

References:	(List of books)
	Textbooks: 1. Information Dashboard Design: Displaying Data for At-a-glance Monitoring” by Stephen Few 2. "Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsk

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Urban Transportation Planning**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
Course Synopsis	This course introduces students to the fundamentals and methodologies of transportation planning in urban contexts. It focuses on transportation system characteristics, travel demand modelling, data collection techniques, land use-transport interaction, and sustainable urban mobility solutions. Students will gain the ability to plan and evaluate transportation systems in alignment with urban growth, policy, and technology.

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

CO1	Understand the principles, processes, and policies involved in urban transportation planning.
CO2	Apply travel demand forecasting techniques and data analysis methods for urban transport planning.
CO3	Analyze the interaction between land use and transportation systems.
CO4	Evaluate transportation plans and mobility strategies for sustainable urban development.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	2	2			2			3		3	2	3
CO2	3	3	2	2	2			2			3		3	2	2
CO3	3	3	2	2	2			2					3	2	2
CO4	3	3	3	3	2			2			2		3	3	3
Average	3	3	2.5	2.2	2			2			2		3	2.4	2.6

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Role of transportation in urban development; components of urban transportation systems; planning process and goals (C2 – Understand).	

	Transportation planning institutions and policies; historical evolution of urban transportation planning (C2 – Understand). Stages in transportation planning process (C3 – Apply).
2	Data collection methods: household surveys, O-D surveys, traffic counts, GPS-based tracking (C2 – Understand). Trip generation using cross-classification and regression methods (C3 – Apply). Trip distribution models: growth factor and gravity models (C3 – Apply). Modal split and mode choice modeling using logit models (C4 – Analyze). Traffic assignment techniques: all-or-nothing, incremental assignment, and user equilibrium (C4 – Analyze).
3	Concept of land use models and activity systems; impact of transportation on land development patterns (C2 – Understand). Accessibility and mobility indices (C3 – Apply). Integrated land use–transportation models (C4 – Analyze). Case studies on urban form and transport network evolution (C4 – Analyze).
4	Urban transport issues: congestion, pollution, equity, and affordability (C2 – Understand). Strategies for sustainable transportation: NMT, public transport, TDM, TOD (C3 – Apply). Urban mobility planning frameworks (e.g., SUMPs, CMPs) (C3 – Apply). Evaluation of transport policies and economic appraisal using cost-benefit analysis and multicriteria methods (C4 – Analyze).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓

Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Assessment Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:

Text Books

1. **Kadiyali, L.R.**, *Traffic Engineering and Transportation Planning*, Khanna Publishers
2. **Papacostas, C.S. and Prevedouros, P.D.**, *Transportation Engineering and Planning*, Pearson Education

Reference Books

1. **H.C. Bhatia**, *Urban Transport: Planning and Management*, S. Chand
2. **Meyer and Miller**, *Urban Transportation Planning: A Decision-Oriented Approach*, McGraw-Hill
3. **Vukan Vuchic**, *Urban Transit Systems and Technology*, Wiley
4. **S.P. Bindra**, *Principles and Practice of Highway Engineering*, Dhanpat Rai Publications
5. Reports by **MoHUA (India), NITI Aayog, and UN-Habitat on Urban Mobility**

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107121
Course Title	**Waste water treatment**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
Course Synopsis	This is a course on the fundamental wastewater systems. Different areas of waste water treatment methodologies have been incorporated to develop better understanding of the students. Also, students will learn current and emerging practices and procedures for the planning, design, and operation of wastewater facilities. Emphasis will be placed on integrating individual unit operations and processes to achieve overall treatment objectives and to satisfy given constraints.

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

CO1	Apply the basics of waste water treatment methodologies
CO2	Understand the Design involved in the waste water treatment systems.
CO3	Apply the basics understanding of the parameters involved in waste water treatment systems.
CO4	To know the different reactors systems working currently used at municipal corporation.
CO5	Understand the Waste Water generation points and their characteristics, with legislation involved.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	3	1	1	2	3	1	3	2	2
CO2	3	2	3	2	1	1	3	2	3	2	2	2	3	3	2
CO3	2	3	3	3	3	3	1	2	3	3	1	1	3	3	1
CO4	3	3	2	2	1	2	2	3	1	1	2	3	3	2	2
CO5	1	3	2	1	2	2	1	2	2	3	2	1	3	3	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2.8	1.6

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Acquire knowledge about wastewater flow and its characteristics, including the types of wastewaters and their composition. Understand the wastewater collection systems, including the network of pipes and components used for collecting and transporting wastewater. Learn about the estimation and variation of wastewater flows, including factors such as population, water usage patterns, and seasonal variations. Gain knowledge about the problems associated with industrial wastewaters and the need for specialized treatment. Familiarize yourself with sampling protocols for wastewater analysis. Learn about equalization and neutralization processes used to balance and adjust wastewater characteristics. Understand the concepts of proportioning processes and volume and strength reduction techniques. Acquire knowledge about the preliminary, primary, secondary, and tertiary wastewater treatment processes. Learn about the theory and design principles of screens, grit chambers, sedimentation tanks, coagulation, and flocculation processes. C1 (Remember), C2 (Understanding) Apply knowledge of wastewater flow and characteristics to assess and analyze wastewater collection systems. Apply estimation techniques to determine wastewater flows for design and planning purposes. Apply knowledge of industrial wastewater problems to identify appropriate treatment strategies. Apply sampling protocols to collect representative wastewater samples for analysis. Apply equalization and neutralization techniques to balance and adjust wastewater characteristics. Apply proportioning processes to optimize wastewater treatment efficiency. Apply design principles to design and select appropriate screens, grit chambers, sedimentation tanks, and treatment processes. C3 (Application)	
2	Acquire knowledge about physio-chemical and biological treatment strategies for wastewater, including their principles and mechanisms. Understand the theory of the activated sludge process (ASP) and other treatment systems such as extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactors, and rotating biological contactors. Learn about the evaluation methods used to assess the performance and effectiveness of these treatment strategies. Understand the concept of mass balancing in ASP and TF and its significance in system design. C1 (Remember), C2 (Understanding) Apply knowledge of physio-chemical and biological treatment strategies to select appropriate treatment systems for specific wastewater characteristics and treatment objectives. Apply the principles of the activated sludge process and other treatment systems to design and optimize their performance. Apply evaluation methods to assess the efficiency and effectiveness of different treatment strategies. Apply mass balancing techniques in the design and operation of ASP and TF systems. C3 (Application)	
3	Acquire knowledge about anaerobic treatment processes and their significance in wastewater treatment. Understand the effects of pH, temperature, and other parameters on anaerobic treatment performance.	

	Familiarize yourself with different anaerobic treatment technologies, including the anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors, and up flow anaerobic sludge blanket (UASB) reactor. C1 (Remember), C2 (Understanding) Apply knowledge of anaerobic treatment processes to select appropriate treatment technologies for specific wastewater conditions and treatment goals. Apply the understanding of pH, temperature, and other parameters to optimize anaerobic treatment performance. Apply the design principles and operational considerations of anaerobic contact processes, anaerobic filters, anaerobic fixed film reactors, fluidized bed and expanded bed reactors, and UASB reactors. C3 (Application)
4	Acquire knowledge about Indian standards for the disposal of treated wastewater on land and in natural streams. Understand the concept of treated wastewater reclamation and reuse. Familiarize yourself with innovative wastewater treatment technologies such as duckweed ponds, vermiculture, and root zone technology. Stay updated on recent advancements in wastewater treatment technologies. C1 (Remember), C2 (Understanding) Apply knowledge of Indian standards to ensure compliance with regulations for the disposal of treated wastewater. Apply the principles of treated wastewater reclamation and reuse to develop sustainable water management strategies. Apply the understanding of duckweed ponds, vermiculture, and root zone technology to design and implement appropriate wastewater treatment systems. Apply knowledge of recent technologies to select the most suitable treatment methods for specific wastewater streams. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Peer Group activities	✓	✓	✓	✓	✓
Quiz	✓	✓	✓	✓	✓
Seminars	✓	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:

Text Books

1. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc Graw Hill.

Reference Books

1.Fair, G.M. & Geyer, J.C. "Water supply and Wastewater Disposal", John Wiley & Sons.

2.Qasim, S.R., Motley, E.M., and Zhu, G. "Water Works Engineering", Prentice Hall Publication.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology in Civil Engineering
Course Code	
Course Title	**Design of Tall Buildings**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	Structural Analysis
Course Synopsis	Classification of buildings, Three dimensional analysis, Shear wall system, In-filled frame system, Plane frame system.

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

CO1	Know the types of tall buildings.
CO2	Analyze the plane frame systems by different methods.
CO3	Design the shear wall systems and in filled frame systems.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	**1**	**-**	**3**	**3**	**3**	**3**	**1**	**-**	**3**	**3**
CO2	**1**	**-**	**3**	**3**	**3**	**3**	**1**	**-**	**3**	**3**
CO3	**1**	**-**	**3**	**3**	**3**	**3**	**1**	**-**	**3**	**3**
Average	**1**	**-**	**3**	**3**	**3**	**3**	**1**	**-**	**3**	**3**

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content
1	Describe the importance of tall buildings (C2, Understand) - Classify the buildings according to NBC (C2, Understand) – Explain the types of load wind load, Seismic load, Quasi static approach (C2, Understand).
2	Discuss the plane frame system (C2, Understand)- Describe the method of Calculation of wind load (C2, Understand) – Explain approximate method (C2, Understand) – Appraise the significance of cantilever and factor methods (C5, Evaluate) – Explain Kani's method (C2, Understand) – Discuss the substitute frame method for dead load and live loads (C2, Understand).
3	Explain Shear Wall System (C2, Understand), Describe Rosman's analysis, Design aspect, RC frame and shear wall interaction – Equivalent frame method (C2, Understand), Compare the different methods of analysis (C4, Analyze), Design of shear wall system (C6, Create)

4	Discuss In-filled Frame Systems: Importance – Methods of analysis (C2, Understand), Compare Equivalent truss and frame method, Force-displacement method (C4, Analyze), Design and analysis of in filled frame system (C6, Create)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	32
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	8
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	5
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3
Peer Group activities	✓	✓	✓
Quiz	✓	✓	✓
Seminars	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓
Comprehensive assessment	✓	✓	✓
University End Term Examination	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1.Regular feedback through Mentor Mentee system 2.Feedback between the semester through google forms	
References:	
	Text Books 1. Bryan Stafford Smith and Alex Coull, (2011), Tall Building Structures: Analysis and Design, Wiley India, ISBN-13: 9788126529896. **Reference books**

	1. Sarwar Alam Raz, (2002), Structural Design in Steel, Second Edition, New Age International, ISBN-13: 9788122432282.

Course for Specialization

Structural Engineering

Prestressed Concrete	3	0	0	3
Prestressed Concrete Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Prestressed Concrete**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course focuses on the principles, materials, design, and analysis of prestressed concrete structures. It covers pre-tensioning and post-tensioning systems, stress losses, design of beams and slabs, end block design, and applications in bridges and buildings. Emphasis is placed on IS:1343 code provisions and real-world applications of prestressing technology.

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

CO1	Understand the principles, materials, and systems of prestressing in concrete..
CO2	Analyze stresses and losses in prestressed concrete members
CO3	Design prestressed concrete beams, slabs, and end blocks as per codal provisions..
CO4	Evaluate applications of prestressed concrete in infrastructure and assess its advantages over conventional reinforced concrete.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Basic concepts of prestressing, advantages over RCC, types of prestressing – pre-tensioning and post-tensioning (C2 – Understand). Materials used for prestressed concrete – high strength concrete and steel (C2 – Understand). Methods and systems of prestressing including Freyssinet, Gifford-Udall, and Lee-McCall systems (C3 – Apply).	

2	Stress analysis of prestressed beams under various loading and support conditions (C3 – Apply). Load balancing concept and pressure line (C3 – Apply). Types of losses in prestress – elastic shortening, shrinkage, creep, relaxation of steel, anchorage slip, and friction losses (C4 – Analyze).
3	Design of rectangular and I-section prestressed concrete beams for flexure as per IS:1343 (C3 – Apply). Check for ultimate moment, shear, bond, and deflection (C4 – Analyze). Design of end blocks using stress distribution and bursting tension approach (C4 – Analyze). Introduction to limit state design of prestressed members (C3 – Apply).
4	Prestressed concrete in buildings, bridges, water tanks, and rail sleepers (C2 – Understand). Partial prestressing and composite construction (C3 – Apply). Introduction to continuous beams and circular prestressing (C2 – Understand). Durability, inspection, and maintenance aspects (C4 – Analyze).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	25
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps	

<table>
<tr><td colspan="2">1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms</td></tr>
<tr><td>References:</td><td></td></tr>
<tr><td></td><td>Text Books
1. N. Krishna Raju, Prestressed Concrete, Tata McGraw-Hill
2. T.Y. Lin and Ned H. Burns, Design of Prestressed Concrete Structures, Wiley India</td></tr>
</table>

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Prestressed Concrete Lab**
Academic Year	III
Semester	VI
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The Prestressed Concrete Lab provides practical exposure to the principles and applications of prestressing techniques used in modern concrete construction. The course enables students to understand the behavior of prestressed elements through hands-on experiments. It includes the demonstration and execution of both pre-tensioning and post-tensioning processes using jacks and anchorage systems. Students will perform tests to determine flexural behavior, cracking patterns, and stress losses in prestressed beams. The course also introduces instrumentation techniques such as strain measurement and deflection monitoring. By comparing theoretical predictions with experimental results, students gain insights into the mechanical performance and efficiency of prestressed systems in structural applications. This lab enhances the learner's ability to apply IS:1343 standards and engineering judgment in evaluating prestressed structures.

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

CO1	Understand behavior of prestressed concrete components through experiments.
CO2	Demonstrate pre-tensioning and post-tensioning procedures in the laboratory.
CO3	Evaluate flexural and tensile strength of prestressed specimens.
CO4	Analyze experimental data for stress losses and compare with theoretical predictions.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)		T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0		0	2	2
Experiment No.	**Content**			
1.	Study of prestressing systems and equipment (jacks, anchorages, wires)			
2.	Demonstration of pre-tensioning technique in beam casting			
3.	Demonstration of post-tensioning in slab or beam using tensioning jacks			
4.	Measurement of prestress losses in a beam using strain gauges			
5.	Testing of pre-tensioned prestressed beam for flexural strength			
6.	Testing of post-tensioned beam for load-deflection behavior			
7.	Comparison of crack behavior in prestressed vs RCC beams			
8.	Determination of modulus of elasticity of prestressing steel			
9.	Measurement of bursting tension in end block using strain rosettes (model scale)			
10.	Preparation of report with comparison of experimental vs theoretical stress values			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓

Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	2. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Course for Specialization

Green Technology and Sustainable Engineering

Environmental Impact Assessment and Sustainable Planning	3	0	0	3
Environmental Impact Assessment and Sustainable Planning Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Environmental Impact Assessment and Sustainable Planning**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course introduces the principles, legal framework, and methodologies of Environmental Impact Assessment (EIA) and its role in sustainable infrastructure development. It equips students with tools to assess environmental effects of engineering projects, interpret environmental regulations, conduct scoping and screening, and prepare Environmental Management Plans (EMPs). Emphasis is placed on integrating sustainability into the planning and design of civil infrastructure to reduce ecological footprints and enhance resilience.

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

CO1	Understand the concepts and legislative framework of EIA and sustainable development.
CO2	Apply EIA methodologies for project screening, scoping, baseline data analysis, and impact prediction.
CO3	Analyze the environmental impacts of civil engineering projects and propose appropriate mitigation measures.
CO4	Evaluate sustainability indicators and implement environmental management strategies in planning and decision-making.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-

CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Definition and need of EIA, historical development, key terms and principles (C2 – Understand). Sustainable development goals (SDGs) and their relevance to infrastructure planning (C2 – Understand). Legal and institutional frameworks – EIA notifications, MoEF guidelines, and CPCB norms (C3 – Apply).	
2	Screening and scoping techniques; baseline data collection for air, water, land, and socio-economic components (C3 – Apply). Impact identification and prediction methods including checklists, matrices, and overlays (C3 – Apply). Quantitative techniques like Leopold Matrix and network analysis (C4 – Analyze). Risk assessment and cost-benefit analysis (C4 – Analyze).	
3	Environmental Management Plans (EMPs), mitigation strategies, and pollution control options (C3 – Apply). Monitoring protocols, post-project environmental audits, and environmental clearance procedures (C4 – Analyze). Case studies of infrastructure projects like highways, dams, industries, and urban development (C4 – Analyze).	
4	Concepts of low-impact development (LID), climate-resilient infrastructure, and green rating systems (GRIHA, IGBC) (C2 – Understand). Life Cycle Assessment (LCA) and sustainability indicators (C3 – Apply). Integration of GIS in environmental planning and decision-making (C4 – Analyze). Tools for participatory and inclusive planning (C3 – Apply).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--

Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Text Books 1. **Canter, L.W.**, *Environmental Impact Assessment*, McGraw-Hill 2. **Rao, P. Venugopala**, *Environmental Impact Assessment*, PHI Learning

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Environmental Impact Assessment and Sustainable Planning Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab course provides hands-on exposure to the practical aspects of EIA and sustainable planning. Students will collect and analyze baseline environmental data, apply EIA techniques, prepare environmental management plans, and use GIS software for impact visualization. The lab emphasizes simulation-based learning, case studies, and project-based assessments for real-world understanding of sustainability integration in civil infrastructure.

Course Outcomes:

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

CO1	Collect and interpret environmental baseline data relevant to EIA studies.
CO2	Apply EIA tools like checklists, matrices, and GIS-based overlays to assess project impacts.
CO3	Prepare environmental management and mitigation plans for civil projects.
CO4	Evaluate sustainability indicators and develop strategies for green planning.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Measurement of ambient air quality (PM, NOx, SO_2) using portable analyzers			
2.	Water quality analysis (pH, turbidity, DO, BOD) for environmental baseline studies			
3.	Application of Leopold Matrix for impact assessment			
4.	Preparation of checklist and overlay method for EIA			
5.	Use of GIS software for land use and impact visualization			
6.	Case study on highway/industry EIA and EMP preparation			
7.	Conducting stakeholder analysis and public consultation techniques			
8.	Evaluation of green building rating (GRIHA or IGBC) for a sample project			
9.	Life Cycle Assessment (LCA) of construction material or system			
10.	Simulation or modeling of urban environmental planning scenarios			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	**Summative**

Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

Course for Specialization

Construction Technology

Automation and Robotics in Construction	3	0	0	3
Automation and Robotics in Construction Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Automation and Robotics in Construction**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course introduces students to the fundamentals of automation and robotics as applied to civil engineering and construction projects. It explores the principles, systems, and technologies involved in automating construction processes, including the use of robots, drones, 3D printing, sensors, and AI-based control systems. Students will learn how automation enhances productivity, safety, quality, and sustainability in the construction industry.

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

CO1	Understand the principles and components of automation and robotics in construction.
CO2	Apply robotics and control systems in construction tasks such as material handling, bricklaying, and inspection.
CO3	Analyze the integration of automation technologies like drones, 3D printing, and AI in modern construction.
CO4	Evaluate the feasibility, productivity, and challenges of automation systems in real-world construction projects.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3		0	0	3

Unit	Content	Competencies
1	Definition and scope of automation in construction; evolution from manual to automated systems (C2 – Understand). Classification of construction robots and automation equipment (C2 – Understand). Advantages of automation in safety, quality, and labor efficiency (C3 – Apply).	
2	Fundamentals of robotic systems: sensors, actuators, controllers, manipulators, end-effectors (C2 – Understand). Robot kinematics and dynamics for construction tasks (C3 – Apply). Mobile robots and robotic arms used for material handling and site inspection (C3 – Apply). Case studies of bricklaying, welding, and painting robots (C4 – Analyze).	
3	3D printing in construction: printing methods, materials, and structural applications (C3 – Apply). Drones in construction monitoring, surveying, and progress tracking (C3 – Apply). AI and machine learning in equipment management and autonomous site operation (C4 – Analyze). Real-time data acquisition and IoT in smart construction sites (C4 – Analyze).	
4	Automation planning, implementation challenges, and cost-benefit analysis (C4 – Analyze). Comparison of traditional vs automated construction productivity (C4 – Analyze). Safety, legal, and ethical aspects of deploying robots on construction sites (C2 – Understand). Case studies on automation in high-rise construction, tunnels, and prefabrication plants (C4 – Analyze).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination

Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. **S. C. Sharma,** ***Construction Equipment and Management*****, Khanna Publishers** 2. **Sushil Kumar,** ***Construction Planning and Management*****, Standard Publishers** 3. **Bock, Thomas & Linner, Thomas,** ***Robotic Industrialization: Automation and Robotic Technologies for Customized Component, Module, and Building Prefabrication*****, Cambridge University Press**

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Automation and Robotics in Construction Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab course provides hands-on experience in the application of automation and robotics technologies used in construction. Students will work with basic robotic systems, perform simulations of construction tasks using automation tools, program simple robotic arms, and experiment with 3D printing and drone-based site monitoring. The lab emphasizes real-world problem-solving through project-based learning and interactive sessions.

Course Outcomes:

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

CO1	Operate and simulate basic robotic systems for construction tasks.
CO2	Apply automation tools like 3D printing, drone mapping, and PLCs.
CO3	Develop and test small-scale automated systems using microcontrollers and sensors.
CO4	Evaluate the efficiency and potential of construction automation technologies through lab-based case studies.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Introduction to construction robotics, safety protocols, and hardware systems			
2.	Programming a robotic arm to simulate bricklaying or pick-and-place operations			
3.	Simulation of material transportation using mobile robot or conveyor system			
4.	Use of drone or drone simulator for site mapping and progress tracking			
5.	3D printing of basic structural components using concrete/mortar-based material			
6.	Interfacing sensors and microcontrollers (e.g., Arduino) for automation control			
7.	PLC-based automation of site lighting or material lifting system			
8.	IoT-based real-time monitoring and data collection from a simulated construction site			
9.	Comparative study: manual vs robotic operation for a construction task			
10.	Mini project: prototype automation for a construction function			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

SEMESTER - VII

Course Code	Course Title
	Construction Project Management
	Railways, Tunnel and Airport Engineering
	Geotechnical Engineering-II
	Geotechnical Engineering-II Lab
	Capstone Project
	SEC-V (Valuation & Costing Lab)
	Industrial Training - II
	Essence of Indian Knowledge Tradition (MCNC)
Program Elective-V Pool (Choose One from the pool)	
	Energy Efficient Structure
	Climate Change
	Stochastic Hydrology
	Bridge Engineering
Program Elective-V (Choose One from the pool)	
	Prefabrication and 3D Printing in Construction
	New Age Transit System
	River Engineering
	Earthquake Engineering
Additional Credits for Specialization Structural Engineering	
	Structural Dynamics
	Structural Dynamics Lab
Additional Credits for Specialization Green Technology and Sustainable Engineering	
	Water and Waste Management for Sustainable Development
	Water and Waste Management for Sustainable Development Lab
Additional Credits for Specialization Construction Technology	
	Prefabrication and Modular Construction
	Prefabrication and Modular Construction Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107113
Course Title	**Construction Project Management**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Understanding the various stages of project, Economic and financial analysis of project, Project selection, Network scheduling, Use of computer programs, Project bid, Project operation

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

CO1	Fundamental of project management
CO2	Describe and understand the project planning and management tools
CO3	Planning and Scheduling of Activity
CO4	Determine minimum total cost in minimum time for updating and rescheduling a project.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P0 12	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	2	2
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	3	1
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	3	3
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	2	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2.5	2

S

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
2	**0**	**0**	**2**

Unit	Content	Competencies
1	Acquire knowledge about the foundations of project management and the key components of a project life cycle. Understand the project environment and the factors that influence project selection. Learn about the purpose and components of a project proposal. Gain knowledge about project scope and its importance in project management. C1 (Remember), C2 (Understanding) Apply project management principles and techniques to initiate, plan, execute, and close projects. Apply project selection methods to evaluate and prioritize potential projects. Apply project proposal frameworks to develop	

	comprehensive project proposals. Apply scope management techniques to define and manage project boundaries and deliverables. C3 (Application)
2	Acquire knowledge about the breakdown structure, network scheduling, critical path method (CPM), program evaluation and review technique (PERT), and assumptions in PERT. C1 (Remember), C2 (Understanding) Apply the breakdown structure to organize project deliverables and activities effectively. Apply network scheduling techniques to create project schedules and identify critical paths. Apply the critical path method to analyze project timelines and identify activities that require close monitoring. Apply the PERT technique to estimate project durations and assess project risks. C3 (Application)
3	Acquire knowledge about modeling, time-cost trade-offs, linear programming, network flow formulations, PERT/COST, and accounting in project management. C1 (Remember), C2 (Understanding) Apply modeling techniques to analyze project scenarios and make informed decisions. Apply time-cost trade-offs techniques to optimize project schedules and balance time and cost constraints. Apply linear programming and network flow formulations to solve resource allocation and scheduling problems. Apply PERT/COST techniques to estimate project costs and assess project risks. Apply accounting principles and techniques to track project costs and develop project budgets. C3 (Application)
4	Acquire knowledge about scheduling with limited resources, resource planning, resource allocation, project schedule compression, project scheduling software, precedence diagrams, decision CPM (Critical Path Method), generalized activity networks, and GERT (Graphical Evaluation and Review Technique) in project management. C1 (Remember), C2 (Understanding) Apply scheduling techniques with limited resources to create and manage project schedules. Apply resource planning strategies to allocate resources effectively and optimize resource utilization. Apply project schedule compression techniques to accelerate project timelines while considering resource constraints. Utilize project scheduling software to develop and analyze project schedules. Construct precedence diagrams to depict task dependencies and logical relationships. Apply decision CPM techniques to analyze project scenarios and make informed decisions. Utilize generalized activity networks and GERT to model complex project constraints and uncertainties. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	20
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	5
Problem Based Learning (PBL)	5
Case/Project Based Learning (CBL)	--

Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. Projects: Planning, Analysis, Selection, Implementation & Review, Prasanna Chandra, 5th Ed., 2002. 2. Project Management: A systems approach to planning and controlling, Harold Kerzner, CBS Publisher, New Delhi, 2nd Ed., 2000. **Reference Books** 1. Lock, D., 2003, Project Management, 8th edition, Gower Publishing Limited 2.AMS REALTIME projects http://www.amsrealtime.com/products/project.htm

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107120
Course Title	**Railways, Tunnel and Airport Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course offers a comprehensive understanding of the engineering principles and practices related to railways, tunnels, and airports. It covers topics such as railway alignment and track design, tunneling methods and design considerations, airport planning and design, and runway and terminal construction. Students will gain knowledge of the unique challenges and design criteria for each of these transportation infrastructure components.

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

CO1	Understand the planning and design considerations for railways, tunnels, and airports.
CO2	Analyse and design railway tracks, including alignment, track components, and track systems.
CO3	Apply principles of earthwork and drainage in railway and airport construction.
CO4	Understand different tunnelling methods and design considerations for tunnels.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	2	3	3	3	3	3	1	2	3	3	1	1	3	3	3
CO2	3	1	1	2	1	2	2	3	1	1	2	3	3	2	3
CO3	2	2	3	1	2	2	1	2	2	3	2	1	3	2	1
CO4	3	1	1	2	3	2	2	3	1	1	2	3	3	3	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Acquire knowledge about railway alignment and surveying techniques. Understand the components and geometry of railway tracks. Learn about	

	track design principles and maintenance practices. Familiarize yourself with the classification and types of tunnels. Gain knowledge about tunnel construction methods and the considerations involved in tunnel design. C1 (Remember), C2 (Understanding) Apply knowledge of railway alignment and surveying techniques to determine the optimal alignment for a given railway project. Apply track design principles and standards to design safe and efficient railway tracks. Apply track maintenance techniques to ensure the smooth operation and longevity of railway tracks. Apply knowledge of tunnel construction methods to select the appropriate method for a specific tunnel project. Apply tunnel design considerations to develop safe and functional tunnel designs. C3 (Application)
2	Acquire knowledge about tunneling methods and their purposes. Understand the factors that influence the choice of excavation techniques for tunnels. Learn about different methods used in soft ground tunneling, hard rock tunneling, shallow tunneling, and deep tunneling. Familiarize yourself with techniques such as cut and cover, cover and cut, pipe jacking, and jacked box excavation. Gain knowledge about muck disposal methods, tunnel support systems, and common problems encountered in tunneling, along with the corresponding remedial measures. C1 (Remember), C2 (Understanding) Apply knowledge of tunneling methods to select appropriate excavation techniques for specific tunnel projects. Apply soft ground tunneling methods to excavate tunnels in cohesive soils. Apply hard rock tunneling techniques to excavate tunnels in rock formations. Apply shallow tunneling methods such as cut and cover, cover and cut, and pipe jacking for tunnel construction in shallow depths. Apply deep tunneling methods to excavate tunnels at significant depths. Apply muck disposal and tunnel support techniques to ensure safe and efficient tunnel construction. Apply remedial measures to address problems encountered in tunneling projects. C3 (Application)
3	Acquire knowledge about airport master planning, including the development and management of airports. Understand the airside and landside components of an airport and their functions. Learn about the environmental considerations involved in airport planning, such as noise pollution, air quality, and land use. Gain knowledge about runway geometry and the safety considerations associated with airport operations. Familiarize yourself with pavement design principles and the selection of appropriate materials for airport pavements. C1 (Remember), C2 (Understanding) Apply knowledge of airport master planning to develop comprehensive plans for airport development and expansion. Apply understanding of airside and landside components to design efficient layouts and facilities for aircraft operations and passenger services. Apply environmental considerations to incorporate sustainability and minimize the environmental impact of airports. Apply runway geometry principles to design safe and efficient runways. Apply pavement design principles to develop robust and durable airport pavements using suitable materials. C3 (Application)

4	Acquire knowledge about construction techniques for runways, including the materials, processes, and equipment involved in runway construction. Understand the functions and layout of passenger terminals, including the various areas and facilities required for efficient passenger flow. Learn about baggage handling systems, their components, and their role in airport operations. Gain knowledge about terminal building design and architecture, including considerations such as aesthetics, functionality, and passenger comfort. C1 (Remember), C2 (Understanding) Apply knowledge of construction techniques to implement efficient and safe runway construction projects. Apply understanding of passenger terminal functions and layout to design user-friendly and functional terminal buildings. Apply knowledge of baggage handling systems to design efficient and secure baggage handling processes. Apply principles of terminal building design and architecture to create aesthetically pleasing and functional terminal structures. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Assessment Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1.Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 1998. 2.Driving Horizontal Workings and Tunnel, by Pokorovski, Mir Publishers, 1980. **Reference Books** 1.Rangwala, Airport Engineering, Charotar Publishing House, 1996. 2.Oza.H.P. and Oza.G.H., "A course in Docks &Harbour Engineering". Charotar Publishing Co.1976 3.Drilling and Blasting of Rocks, by Carlos L Jimeno, A.A. Balkema/Rotterdam/Brookfield 1995.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106116
Course Title	**Geotechnical Engineering-II**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course delves into advanced topics in soil mechanics, focusing on the behavior and properties of soils under complex loading conditions. Key subjects covered include consolidation, shear strength, stress-strain relationships, and soil dynamics. Students will explore advanced laboratory testing methods and numerical modeling techniques to analyze soil behavior. The course also investigates geotechnical design principles for foundations, retaining walls, and slope stability. Through case studies and practical applications, students will develop a deep understanding of advanced soil mechanics principles and their practical implications in geotechnical engineering projects.

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

CO1	Comprehend and utilize the geotechnical literature to establish the framework for foundation design.
CO2	Plan and implement a site investigation program including subsurface exploration to evaluate soil/structure behavior and to obtain the necessary design parameters.
CO3	Carry out slope stability analysis for various fills and slopes.
CO4	Determine allowable bearing pressures and load carrying capabilities of different foundation systems.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	2	2			2			3		3	2	2
CO2	3	3	2	2	2			2			3		3	2	2
CO3	3	3	2	2	2			2					3	2	2
CO4	3	3	3	3	2			2			2		3	2	1
CO5	3	3	3	3	2			2			2		3	2	1
Average	3	3	2.5	2.2	2			2			2		3	2	1.6

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies
1	Understand the concepts related to Mohr’s-Coulomb theory, Tresca theory, and von Mises theory. Gain knowledge about earth pressure, including the active and passive states of earth pressure and pressure at rest. Understand Rankine's and Coulomb's wedge theory. Learn about earth pressure computation for practical cases. C2 (Understand) Apply the principles of Mohr’s-Coulomb theory, Tresca theory, and von Mises theory in analyzing the strength and failure behavior of soils and rocks. Apply the concepts of earth pressure, including the active and passive states of earth pressure and pressure at rest, in analyzing the stability of retaining structures. Apply Rankine's and Coulomb's wedge theory in analyzing slope stability. Apply earth pressure computation methods for practical cases to determine the loads acting on retaining structures and slopes. C3 (Application) Analyze the suitability and limitations of different theories in predicting material behavior and stability. Analyze the factors influencing earth pressure and slope stability. Analyze the accuracy and reliability of earth pressure computation methods. C4 (Analysis)	
2	Understand the concepts related to the failure of finite and infinite slopes. Learn about the Swedish circle method, Friction Circle method, Taylor's stability number, stability curves, factor of safety, slope stability of earth dams, and the introduction to Bishop's method. C2 (Understand) Apply the Swedish circle method, Friction Circle method, Taylor's stability number, and stability curves in analyzing slope stability. Apply the concept of factor of safety in determining slope stability. Apply the principles of slope stability analysis to assess the stability of earth dams. Apply the introductory concepts of Bishop's method in slope stability analysis. C3 (Application) Analyze the suitability and limitations of different methods and concepts in predicting slope stability. Analyze the factors influencing slope stability and the stability of earth dams. Analyze the principles and limitations of Bishop's method. C4 (Analysis)	
3	Understand the concepts related to bearing capacity, minimum depth of foundation, failure theories, Meyerhof's analysis, different equations for bearing capacity, and the effect of the water table on bearing capacity. Learn about the IS code method for computing bearing capacity. Understand shallow foundations, safe bearing capacity, settlement of footings (immediate and time-dependent settlement), and permissible limits. Gain knowledge about deep foundations, classification and selection of piles, static and dynamic formulae for single pile capacity, efficiency and capacity of pile groups, settlement of pile groups, load tests on piles as per BIS codes, and classification and selection of under reamed piles. C2 (Understand) Apply the concepts of bearing capacity analysis, including Meyerhof's analysis and IS code methods. Apply the principles of shallow foundation	

	design, including safe bearing capacity and settlement analysis. Apply the principles of deep foundation design, including classification and selection of piles, single pile capacity analysis using static and dynamic formulae, efficiency and capacity analysis of pile groups, settlement analysis of pile groups, and conducting load tests on piles as per BIS codes. Apply the principles of classification and selection of under reamed piles. C3 (Application) Analyze the suitability and limitations of different methods and equations for bearing capacity analysis. Analyze the factors influencing the bearing capacity, such as soil properties and the presence of water. Analyze the factors influencing settlement of footings and the permissible limits. Analyze the factors influencing the classification and selection of piles and under reamed piles. Analyze the accuracy and reliability of load tests on piles for assessing pile performance and capacity. C4 (Analysis)
4	Understand the objective of site investigation in foundation engineering. Learn about the different stages of site investigation, including reconnaissance and detailed site investigation. Gain knowledge about the methods of exploration used in site investigation, including geophysical methods and seismic refraction survey. Understand the concept of depth of exploration, selection of foundation, plate load test, and standard penetration test. C2 (Understand) Apply the concepts of site investigation, including reconnaissance and detailed site investigation, to assess subsurface conditions. Apply different methods of exploration, such as drilling techniques, geophysical methods, and seismic refraction survey, to collect data on soil and rock properties. Apply the concept of depth of exploration to determine the appropriate depth for investigating the subsurface conditions. Apply the principles of selecting the suitable foundation type based on site investigation data. Apply the knowledge of plate load test and standard penetration test to assess soil properties in-situ. C3 (Application) Analyze the importance and objectives of site investigation in foundation engineering. Analyze the strengths and limitations of different methods of exploration and geophysical techniques in collecting subsurface data. Analyze the interpretation of seismic refraction survey data to determine subsurface layering and velocity profiles. Analyze the factors influencing the depth of exploration and its impact on foundation design. Analyze the factors influencing the selection of the appropriate foundation type based on site investigation data. Analyze the principles and procedures of plate load test and standard penetration test and their relevance in foundation design. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4

Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. Dr. K.R. Arora , Soil Mechanics and Foundation Engineering(2011), ISBN No. 81-8014-112-8, Seventh Edition, Standard Publishers Distributors, Delhi . **Reference Books** 1. Shashi K. Gulhati&Manoj Datta, Geotechnical Engineering, Tata McGraw Hill Ltd. 2. Donald P Coduto, William A. Kitch, Man-chu Ronald Yeung, Geotechnical Engineering: Principles and Practice, Pearson Education. 3. Joseph E. Bowles, Foundation Analysis and Design, McGraw-Hill, New York. 4. Arun Kr. Jain, & B.C. Punmia, Ashok Kr. Jain, Soil Mechanics and Foundations, Laxmi Publications.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Geotechnical Engineering-II Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The Advanced Geotechnical Engineering Lab provides practical exposure to specialized and in-depth testing methods for soil and rock mechanics, foundation behavior, and ground improvement evaluation. Students will conduct experiments related to soil strength, permeability, consolidation, and in-situ testing simulations. The course emphasizes interpretation of advanced soil behavior parameters and geotechnical report preparation aligned with modern design requirements and IS codes.

Course Outcomes:

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

CO1	Conduct and interpret advanced laboratory tests to determine shear strength, compressibility, and permeability of soils.
CO2	Analyze soil behavior under different drainage and loading conditions using appropriate testing methods.
CO3	Evaluate geotechnical parameters for foundation and ground improvement design.
CO4	Prepare technical reports based on IS standards and analyze data for practical geotechnical applications.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Determination of permeability of soil using the falling head method			
2.	Determination of coefficient of consolidation using oedometer test			
3.	Unconfined compression test (UCC) on cohesive soil			
4.	Triaxial shear test (UU/CU/CD) and determination of shear strength parameters			
5.	Direct shear test and analysis of shear parameters under drained conditions			
6.	Swelling pressure test on expansive soil			
7.	Standard penetration test (SPT) data interpretation and N-value corrections			
8.	California Bearing Ratio (CBR) test (laboratory and field simulation)			
9.	Model pile load test (vertical compression or lateral load)			
10.	Report preparation: Geotechnical investigation case study and bore log interpretation			

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative

Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107115
Course Title	**Capstone Project**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	In this course, student will complete the thesis work.

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

CO1	Solve complex structural problems by applying appropriate techniques and tools.
CO2	Exhibit good communication skill to the engineering community and society.
CO3	Demonstrate professional ethics and work culture.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	1	2	2	-	1	3	2	2
CO2	3	3	3	3	3	2	2	1	2	2	-	1	3	2	2
CO3	3	3	3	3	3	1	1	1	2	2	-	1	3	2	2
Average	3	3	3	3	3	2	2	1	2	2	-	1	3	2	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	**0**	**4**	**4**

Experiment No.	Content
1.	Identify the problem (C2, Understand), Implement the suitable solution (C3, Apply), Experiments and tests (C4, Analyze), Investigate and develop the solution (C6, Create)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	36
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	20
Revision	--
Others If any:	--

Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107116
Course Title	**Valuation & Costing Lab**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	
Course Synopsis	Understanding the various stages of project, Economic and financial analysis of project, Project selection, Network scheduling, Use of computer programs, Project bid, Project operation.

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

CO1	Estimating the quantities and cost for civil engineering structures.
CO2	Demonstrate an ability to prepare rough and detailed building estimate.
CO3	Perform rate analysis as required in preparing specifications, detailed estimate and tender documents etc.
CO4	Analysis the rates of materials and labour.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3									3	2	1
CO2	3	3	3	3	3				3	2	3		3	2	2
CO3	3	3	3	3	3	2							3	2	2
CO4	3	3	3	3		3		2			3		3	2	2
Average	3	3	3	3	1.2	1.6		0.8	0.6	0.4	1.4		3	2	1.75

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	4	4

Experiment No.	Content	Competencies
1.	Use of building estimate spreadsheet	C2 (Understand), C3 (Application)
2.	Estimation of building (long wall and short wall method) using Excel	C3 (Application)
3.	Estimation of building (center line method) using Excel	C3 (Application)
4.	Analysis of rate for concrete work using Excel	C4 (Analyze)
5.	Analysis of rate for brick work using Excel	C4 (Analyze)

6.	Analysis of rate for plaster work using Excel C4 (Analyze)
7.	Estimate quantity of reinforcement using Excel C4 (Analyze)
8.	Preparation for approximate estimate for road project using Excel C6 (Create)
9.	Estimating cost of building on plinth area method using Excel C6 (Create)
10.	Case Study 1
11.	Introduction to Valuation Modeling in Excel C2 (Understand), C3 (Application)
12.	Rental method of valuation using excel C3 (Application)
13.	Direct comparison with capital value using excel C3 (Application)
14.	Valuation based on profit using excel C3 (Application)
15.	Valuation based on cost using excel C3 (Application)
16.	Depreciation method of valuation using excel C3 (Application)
17.	Case Study 2
18.	Case Study 3

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	36
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	20
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓

Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Faculty of Engineering and Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	Essence of Indian Knowledge Tradition
Academic Year	IV
Semester	VII
Number of Credits	NIL
Course Prerequisite	NIL
Course Synopsis	This course is aimed at imparting knowledge on the rich and diverse heritage of India’s intellectual traditions. It introduces students to the philosophical, scientific, and cultural dimensions of Indian knowledge systems. The course covers Indian perspectives on knowledge, science, technology, education, and values that shaped Indian civilization over millennia. Through reflective learning, the students will understand the relevance of ancient wisdom in modern times and develop a sense of pride and responsibility toward India's intellectual legacy.

Course Outcomes:

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

CO1	Understand the foundations and key concepts of Indian Knowledge Systems (IKS).
CO2	Appreciate the philosophical, scientific, and educational contributions of India.
CO3	Analyze the relevance of Indian traditional knowledge in contemporary contexts.
CO4	Develop critical thinking, ethical reasoning, and a holistic worldview from an Indian perspective.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)& Program Specific Outcomes:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	1	3	3	2	1	2	2	2	2	1	-
CO2	2	2	1	1	2	3	3	3	1	2	1	2	2	1	-

CO3	2	1	2	2	2	3	2	2	2	2	2	3	2	1	-
CO4	3	2	2	1	2	3	3	3	2	2	2	2	2	1	1
Average	2.5	1.75	1.5	1.5	1.75	3	2.75	2.5	1.5	2	1.75	2.25	2	1	0.25

Course Content:

L (**Hours/Week**)	**T** (**Hours/Week**)	**P** (**Hours/Week**)	**Total Hour/Week**
2	**0**	**0**	**2**

Unit	**Content & Competencies**
1	**Introduction to Indian Knowledge Systems (C2)** • Overview and Scope of IKS • Characteristics of Indian thought and philosophical traditions • Contributions of Indian sages and scholars **Indian Education System (C2)** • Gurukul system and holistic learning • Teaching-learning processes in ancient India • Value-based education and ethics
2	**Indian Sciences and Mathematics (C3)** • Contributions in astronomy, metallurgy, Ayurveda, mathematics • Indian achievements in architecture, agriculture, and ecology • Understanding of time cycles, zero, decimal system, and measurements **Indian Arts, Literature, and Languages (C2)** • Indian classical arts and their spiritual significance • Ancient Indian scriptures, epics, and literary traditions • Sanskrit as a scientific language
3	**Indian Philosophical Systems (C3)** • Introduction to six systems (Darshanas): Nyaya, Vaisheshika, Samkhya, Yoga, Mimamsa, Vedanta • Concept of Dharma, Karma, and Moksha • Relevance in modern thought and global ethics
4	**Sustainable Living and Indian Culture (C3)** • Indian lifestyle practices for sustainable development • Yoga, Ayurveda, and natural wellness • Environmental harmony and ecological consciousness **Modern Relevance of IKS (C3)** • Role of IKS in contemporary society • Integrating traditional knowledge with modern science • Government initiatives on IKS

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	18
Practical	--
Seminar/Journal Club	3
Small Group Discussion (SGD)	3
Self-Directed Learning (SDL) / Tutorial	3
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	3
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2 (Mid Term 3 is optional)
Assignments	University End Term Examination
Student Seminar	Project
Problem Based Learning (PBL)	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Assignment / Presentation	✓	✓	✓	✓
Mid Semester Examination 1	✓	✓	✓	✓
Mid Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

Feedback Process	1. Student’s Feedback 2. Course Exit Survey

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system.
2. Feedback between the semester through google forms.

3. Course Exit Survey will be taken at the end of semester.	
References:	(List of reference books)
	i) Kapil Kapoor (Ed.), *Textbook of Indian Knowledge Systems*, Indian Institute of Advanced Study, 2005. **ii)** V. N. Jha, *Indian Knowledge Systems – Sanskrit and Allied Fields*, DK Printworld, 2021. **iii)** Michel Danino, *The Indian Mind Then and Now*, National Book Trust, 2014. **iv)** Debashish Banerji, *Seven Quartets of Becoming*, DK Printworld, 2012.

Program Elective - IV

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106120
Course Title	**Energy Efficient Structure**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	The course "Energy Efficient Structures" focuses on the principles, techniques, and technologies used in the design and construction of energy-efficient buildings. It explores strategies to reduce energy consumption, improve thermal comfort, and promote sustainability in the built environment. Students will learn about energy-efficient building envelope design, HVAC systems, lighting design, renewable energy integration, and energy modelling techniques. The course emphasizes the importance of energy conservation and equips students with the knowledge and skills to design and evaluate energy-efficient structures.

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

CO1	Understand the importance of construction safety and its impact on project success.
CO2	Identify and assess safety hazards in construction sites.
CO3	Apply risk management techniques to mitigate safety risks in construction projects.
CO4	Develop safety plans and procedures for construction sites.
CO5	Implement appropriate hazard control measures and safety protocols.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	3	2	2			2			3		3	3	2
CO2	3	3	2	2	2			2			3		3	3	2
CO3	3	3	2	2	2			2					3	3	2
CO4	3	3	3	3	2			2			2		3	3	2
Average	3	3	2.5	2.2	2			2			2		3	3	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies

1	Acquire knowledge about the importance of energy efficiency in the built environment and its impact on sustainability. Understand energy codes, standards, and certifications that regulate energy efficiency in buildings. Learn about life cycle assessment and embodied energy to evaluate the environmental impact of building materials and construction processes. Gain knowledge about the principles of sustainable building design and their role in achieving energy efficiency. Understand the concept of energy audits and benchmarking to assess and improve building energy performance. Learn about data collection and analysis techniques for evaluating energy usage in buildings. Acquire knowledge about energy monitoring and metering techniques to track and manage energy consumption. Understand energy performance indicators and metrics used to measure and compare the energy efficiency of buildings. C2 (Understanding) Apply life cycle assessment and embodied energy concepts in evaluating the environmental impact of building materials and processes. Apply life cycle assessment and embodied energy concepts in evaluating the environmental impact of building materials and processes. C3 (Application) Analyze the impact of energy efficiency in the built environment on energy consumption, cost savings, and environmental sustainability. Analyze energy codes, standards, and certifications to ensure compliance and promote energy-efficient design practices. Analyze energy performance indicators and metrics to evaluate the energy efficiency of buildings and compare their performance. C4 (Analysis)
2	Acquire knowledge about heat transfer mechanisms in buildings, including conduction, convection, and radiation. Understand the properties and characteristics of insulation materials and techniques used to reduce heat transfer. Learn about fenestration design and selection, including windows and doors, to optimize energy efficiency. Gain knowledge about air sealing and thermal bridging mitigation techniques to minimize heat loss and improve insulation. Understand different types of HVAC systems and their energy efficiency characteristics. Learn about load calculations and system sizing to ensure proper HVAC design. Acquire knowledge about energy-efficient equipment selection, including efficient heating and cooling units. Understand control strategies for optimizing HVAC performance and energy efficiency. C2 (Understanding) Apply air sealing and thermal bridging mitigation techniques to enhance building envelope efficiency. Apply knowledge of different HVAC systems and their energy efficiency characteristics to select the most suitable system for a building. Apply load calculations and system sizing methods to properly design HVAC systems. C3 (Application)
3	Acquire knowledge about the principles of daylighting and its benefits, including improved visual comfort, energy savings, and human health and well-being. Understand design strategies for maximizing natural light in buildings, such as building orientation, window placement, and shading devices. Learn about energy-efficient lighting technologies and fixtures, including LED lighting and high-efficiency lamps. Gain knowledge about

	lighting control systems and daylight harvesting techniques that optimize the use of natural light. Understand solar energy systems for electricity generation and heating, wind energy systems, and geothermal systems. Learn about the integration of renewable energy technologies into building design. Acquire knowledge about economic and environmental considerations associated with the implementation of renewable energy technologies in buildings. C1 (Remember), C2 (Understanding) Apply knowledge of energy-efficient lighting technologies and fixtures to select appropriate lighting solutions for energy savings. Apply lighting control systems and daylight harvesting techniques to integrate natural light and artificial lighting effectively. Apply knowledge of solar energy systems, wind energy systems, and geothermal systems to incorporate renewable energy sources into building designs. C3 (Application) Analyze building designs to identify opportunities for maximizing natural light. Analyze the energy efficiency and performance of different lighting technologies and fixtures. Analyze the feasibility and potential benefits of solar energy systems, wind energy systems, and geothermal systems in specific building projects. C4 (Analysis)
4	Acquire knowledge about retrofit strategies for improving energy efficiency in existing buildings, including building envelope upgrades and retrofit techniques. Understand different options for retrofitting HVAC systems to enhance energy performance. Learn from case studies of successful building retrofit projects that have achieved significant energy savings. Familiarize yourself with green building certification systems such as LEED and BREEAM. Gain knowledge about water conservation strategies and technologies to reduce water usage in buildings. Understand the importance of indoor environmental quality and occupant comfort in sustainable building design. Learn about life cycle costing and sustainable materials selection to make informed decisions about building materials and systems. C1 (Remember), C2 (Understanding) Apply green building certification systems' criteria and standards in the evaluation and certification of sustainable retrofit projects. Apply water conservation strategies and technologies to retrofit projects for efficient water management. Apply principles of indoor environmental quality to enhance occupant comfort and well-being in retrofit designs. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--

Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press **Reference Books** 1. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press 2. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**High Speed Rail Engineering**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	Fundamentals of Transportation Engineering and Railway Engineering
Course Synopsis	This course provides in-depth knowledge of the planning, design, construction, and operation of high-speed rail (HSR) systems. It focuses on the principles of high-speed rail alignment, track structures, rolling stock, signaling, operations, and safety standards. Students will understand global practices and technologies and explore India's initiatives toward high-speed rail infrastructure including the Mumbai-Ahmedabad corridor and future prospects.

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

CO1	Understand the principles, components, and evolution of high-speed rail systems.
CO2	Apply geometric and structural design standards for high-speed rail infrastructure.
CO3	Analyze train dynamics, track design, and safety requirements in high-speed rail corridors.
CO4	Evaluate technologies, operational strategies, and sustainability of high-speed rail in the Indian context.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P0 12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	3	1	2	3	3	1	1	3	3	2
CO2	3	1	1	2	1	2	2	3	1	1	2	3	3	3	2
CO3	2	2	3	1	2	2	1	2	2	3	2	1	3	3	2
CO4	3	1	1	2	3	2	2	3	1	1	2	3	3	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	3	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies

1	Acquire knowledge about the introduction to bridges, types of bridges, Definition, classification, and history of high-speed rail (HSR); key components and comparison with conventional rail (C2 – Understand). Advantages of HSR in terms of speed, capacity, energy, and carbon footprint (C2 – Understand). Global HSR systems: Japan (Shinkansen), France (TGV), Germany (ICE), and China (C2 – Understand).
2	Geometric design parameters for HSR: minimum curve radius, superelevation, gradient, and transition curves (C3 – Apply). Track structures for HSR: slab track, ballastless track, and continuous welded rails (C3 – Apply). Earthwork, bridges, tunnels, embankments, and special structural requirements (C4 – Analyze). Station design, platform requirements, and terminal facilities (C3 – Apply).
3	Rolling stock characteristics: lightweight materials, bogie design, propulsion systems (C2 – Understand). Aerodynamics and noise control (C3 – Apply). Signaling and communication systems: ETCS, CBTC, driverless trains (C4 – Analyze). Energy consumption and regenerative braking (C3 – Apply). Operational planning and scheduling (C3 – Apply).
4	Safety measures, fencing, intrusion detection, and emergency management (C4 – Analyze). Maintenance practices and monitoring systems for track and vehicles (C3 – Apply). High-speed rail projects in India – Mumbai-Ahmedabad bullet train, feasibility studies (C2 – Understand). Policy framework, funding models, and Make-in-India initiatives for HSR (C4 – Analyze).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

References:	
	Text Books **V.K. Agnihotri**, *Railway Engineering*, Oxford University Press **Satish Chandra & M.M. Agarwal**, *Railway Engineering*, Oxford University Press **Reference Books** Hay, W.W., *Railroad Engineering*, Wiley **Naweed Syed**, *High-Speed Rail in India: Issues and Challenges*, Springer **UIC and International Railway Journals**, Technical Reports and HSR Guidelines **National High Speed Rail Corporation Ltd. (NHSRCL)** project documents

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	Stochastic Hydrology
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	Hydrology, Probability and Statistics
Course Synopsis	Stochastic Hydrology is a course that focuses on the application of probability and statistics to hydrological processes and their analysis. The course introduces students to the fundamental concepts and principles of stochastic hydrology, including the characterization and modeling of hydrological variables, stochastic processes, frequency analysis, and uncertainty assessment in hydrological predictions

Course Outcomes:

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

CO1	Understand the basic principles and concepts of stochastic hydrology
CO2	Apply probability theory and statistical techniques to hydrological data analysis
CO3	Perform frequency analysis of hydrological events
CO4	Assess uncertainty in hydrological predictions

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P01 2	PSO 1	PSO 2	PSO 3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	2	-
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	2	-
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	2	-
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	2	-
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	-

SCourse Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Understand the significance of stochastic hydrology in engineering and water resources management. Comprehend the principles and applications of probability theory and statistical distributions in stochastic hydrology. Understand the purpose and techniques of descriptive statistics and exploratory data analysis in analyzing hydrological data. C1 (Remember), C2 (Understanding) Apply the principles of stochastic hydrology to analyze and predict hydrological events and processes. Apply probability theory to assess the likelihood of various hydrological events. Apply statistical distributions to model and analyze hydrological variables. Apply descriptive statistics and exploratory data analysis techniques to summarize and visualize hydrological data. C3 (Application)	
2	Understand the process of hydrological data analysis, including data collection methods and the need for data preprocessing. Comprehend the significance of visualizing hydrological data to identify trends, patterns, and outliers. Understand the purpose and interpretation of summary statistics in describing the central tendency, dispersion, and shape of hydrological variables. Understand the principles of hypothesis testing and how it is used to make inferences about hydrological phenomena. C1 (Remember), C2 (Understanding) Analyze hydrological data through appropriate data preprocessing techniques, such as data cleaning, filtering, and transformation. Analyze and interpret data visualizations to identify patterns, trends, and anomalies in hydrological data. Analyze summary statistics to gain insights into the central tendency, variability, and distributional characteristics of hydrological variables. Analyze the results of hypothesis tests to draw conclusions about the relationships or differences in hydrological data. C4 (Analyze)	
3	Understand the nature and characteristics of stochastic processes in hydrology. Comprehend the principles and applications of Markov chains in modeling hydrological phenomena. Understand the significance of time series analysis in analyzing and modeling hydrological data. C1 (Remember), C2 (Understanding) Analyze the behavior and properties of stochastic processes in hydrology, including stationarity, ergodicity, and dependence structure. Analyze the transition probabilities and equilibrium states of Markov chains to understand the dynamics of hydrological systems. Analyze time series data to assess the presence of autocorrelation, seasonality, and other temporal patterns in hydrological variables. C4 (Analyze)	

4	Understand the principles and methods of frequency analysis in hydrology. Comprehend the relationship between return period and exceedance probability in quantifying the likelihood of hydrological events. Understand the concept of probability distributions and their role in representing hydrological variables. Understand the purpose and techniques of flood frequency analysis. C1 (Remember), C2 (Understanding) Analyze the statistical properties of hydrological data to select appropriate probability distributions for frequency analysis. Analyze the parameters of probability distributions using statistical techniques, such as maximum likelihood estimation. Analyze the results of frequency analysis to derive flood frequency curves and estimate flood magnitudes for different return periods. C4 (Analyze)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓

Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	(List of books)
	Text Books 1. Water Resources Systems Planning and Management: An Introduction to Methods, Models, and Applications" by Daniel P. Loucks and Eelco van Beek **Reference Books** 1. Stochastic Modeling of Scientific Data" by Peter Guttorp 2. Time Series Analysis: Forecasting and Control" by George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, and Greta M. Ljung 3. Stochastic Hydrology and Its Use in Water Resources Systems Simulation and Optimization" by Keith W. Hipel and Felix A. Létourneau

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107118
Course Title	**Bridge Engineering**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Introduction to history of bridge-building, including types of bridges, aesthetics, and materials for modern bridges; Loadings on bridges including standard truck and lane loading, impact loads, longitudinal and centrifugal forces, wind and seismic loads, thermal loads; Serviceability criteria including deflection and fatigue; Design of reinforced concrete bridges, slab bridges, concrete slab with steel stringer bridges, T-beam or plate girder bridges, box girder bridges, and prestressed concrete bridges; Bridge maintenance including inspection and rehabilitation.

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

CO1	Relate different design philosophies of the highway and railway bridges.
CO2	Understand the structural behavior of different components of a reinforced concrete and steel bridge.
CO3	Analyze and design different components of a highway and railway bridge, to meet desired needs within realistic constraints such as economy, environment friendly, safety, viable construction and its sustainability under loads standardized by Indian Road Congress (IRC).
CO4	Use the techniques, skills, and modern engineering tools and software necessary for design and detailing.
CO5	Analyze and interpret the results using analytical tools and further plan, design and detail different bridges using relevant and upcoming BIS standards.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	3	1	2	3	3	1	1	3	3	2
CO2	3	1	1	2	1	2	2	3	1	1	2	3	3	3	2
CO3	2	2	3	1	2	2	1	2	2	3	2	1	3	3	2
CO4	3	1	1	2	3	2	2	3	1	1	2	3	3	3	2
CO5	2	2	3	2	1	2	1	2	2	3	2	1	3	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	3	2

<table>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Course Content:</td></tr>
<tr><th colspan="2">L (Hours/Week)</th><th>T (Hours/Week)</th><th>P (Hours/Week)</th><th colspan="2">Total Hour/Week</th></tr>
<tr><td colspan="2">3</td><td>0</td><td>0</td><td colspan="2">3</td></tr>
<tr><th>Unit</th><th colspan="4">Content</th><th>Competencies</th></tr>
<tr><td>1</td><td colspan="5">Acquire knowledge about the introduction to bridges, types of bridges, economic span length, types of loading, dead load, live load, impact effect, centrifugal force, wind loads, lateral loads, longitudinal forces, seismic loads, frictional resistance of expansion bearings, secondary stresses, temperature effect, erection forces and effects, width of roadway and footway, and general design requirements for bridges. C1 (Remember), C2 (Understanding)
Apply knowledge of bridge types and their characteristics to select appropriate bridge designs for specific project requirements. Apply principles of economic span length to determine optimal bridge dimensions. Apply knowledge of loading types to analyze and design bridges for various load scenarios. Apply understanding of frictional resistance of expansion bearings to incorporate expansion joints in bridge designs. Apply knowledge of secondary stresses and temperature effects to assess and mitigate potential structural issues in bridge design. Apply considerations for erection forces and effects to plan and execute bridge construction. Apply design requirements to develop bridge designs that meet safety, durability, and performance standards. C3 (Application)</td></tr>
<tr><td>2</td><td colspan="5">Acquire knowledge about the introduction to structural analysis and design, the method of analysis and design, Courbon's theory, and the grillage analogy. C1 (Remember), C2 (Understanding)
Apply the method of analysis and design to analyze and design structural systems. Apply Courbon's theory to assess the behavior and performance of structural elements. Apply the grillage analogy to simplify the analysis of complex structures. C3 (Application)
Design analysis and design frameworks incorporating the method of analysis and design, Courbon's theory, and the grillage analogy for specific structural applications. Develop innovative approaches to structural analysis and design using advanced techniques and methodologies. C6 (Create)</td></tr>
<tr><td>3</td><td colspan="5">Acquire knowledge about the basic principles of prestressed concrete design, general design requirements, mild steel reinforcement in prestressed concrete members, concrete cover, spacing of pre-stressing steel, slender beams, composite sections, propped and unpropped composite sections, two-stage prestressing, shrinking stresses, and general design requirements for road bridges. C1 (Remember), C2 (Understanding)
Apply the basic principles of prestressed concrete design, general design requirements, and specific design considerations to analyze and design prestressed concrete members and road bridges. C3 (Application)</td></tr>
</table>

4	Acquire knowledge about harmonic analysis and folded plate theory, grillage analogy, finite strip method, and finite element method (FEM). Understand the sub-structure components of bridges, including bed blocks, piers, abutments, and their design loads. C1 (Remember), C2 (Understanding) Apply the theories of harmonic analysis, folded plate theory, grillage analogy, finite strip method, and finite element method to analyze and design bridge structures. Apply the design principles and requirements to determine the dimensions and loads for piers and abutments. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5
Peer Group activities	✓	✓	✓	✓	✓
Quiz	✓	✓	✓	✓	✓
Seminars	✓	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓	✓

Feedback Process	1. Student’s Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	

References:	
	Text Books Victor (2012) "Essentials of Bridge Engineering" 7^{th} Edition, ISBN No. 978-043-89-98, Oxford, New Delhi, India **Reference Books** 1. I.S: 875-1987 Part 1 and 12 - Code of Practice for Design loads for Buildings and Structures, BIS, New Delhi, India. 2. I.S: 1893 2002- Indian Standard Code of Practice for Structural Safety of Structures, BIS, New Delhi, India.

Program Elective - V

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Prefabrication and 3D Printing in Construction**
Academic Year	IV
Semester	VIII
Number of Credits	3
Course Prerequisite	
Course Synopsis	This course introduces students to modern methods of construction focusing on prefabrication and 3D printing. It covers planning, design, production, transportation, and assembly of prefabricated components along with material science, digital modeling, and additive manufacturing techniques used in 3D printed construction. Students will develop an understanding of how these methods contribute to speed, quality, sustainability, and cost-efficiency in construction projects.

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

CO1	Understand the concepts, materials, and technologies used in prefabricated and 3D printed construction.
CO2	Apply the process of design and production of prefabricated components and 3D printed structures.
CO3	Analyze the performance, economics, and limitations of prefabrication and 3D printing in civil construction.
CO4	Evaluate the role of these technologies in sustainable, disaster-resilient, and rapid urban infrastructure development.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	2	1
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	2	1
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	2	1
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	2	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies

1	Definition and need for prefabrication; advantages and limitations compared to traditional construction (C2 – Understand). Types of prefabricated systems: panelized, volumetric, hybrid, and modular (C2 – Understand). Planning for prefabricated construction including design standardization, tolerances, and modular coordination (C3 – Apply).
2	Manufacturing processes in precast yards; formwork, casting, and curing techniques (C3 – Apply). Transportation logistics and site assembly using cranes and mechanical equipment (C3 – Apply). Jointing techniques: dry connections, welding, and bolted joints (C4 – Analyze). Case studies on prefabricated housing, bridges, and commercial buildings (C4 – Analyze).
3	Principles of additive manufacturing and layering methods (C2 – Understand). Printing materials: cementitious mixes, geopolymer concrete, fiber-reinforced mixes (C3 – Apply). Hardware systems: gantry-type, robotic-arm, and mobile printers (C3 – Apply). File preparation, G-code generation, and digital modeling tools (BIM integration) (C4 – Analyze).
4	Comparison of 3D printing and prefabrication with conventional techniques (C4 – Analyze). Applications in rapid housing, disaster response, infrastructure repair, and space architecture (C2 – Understand). Environmental benefits, material optimization, and reduction in construction waste (C4 – Analyze). Legal, safety, and certification issues (C2 – Understand).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓

Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:

Textbooks

M.M. Goyal, Prefabricated Construction, Standard Publishers

Sushil Kumar, Building Construction, Standard Publishers

Reference Books

1. Earthquake Resistant Design of Structures By Pankaj Agarwal & Manish Shrikhande, PHI Publications
2. Manish Shrikhande & Pankaj Agrawal; Earthquake Resistant Design of Structures, PHI Publication, New Delhi
3. Clough & Penzin; Dynamics of Structures

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**New Age Transit System**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	Highway Engineering
Course Synopsis	This course introduces students to the emerging trends and technologies in the field of transportation systems. It covers various aspects of new age transit, including intelligent transportation systems (ITS), electric and autonomous vehicles, shared mobility, and sustainable transportation solutions.

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

CO1	Demonstrate knowledge and understanding of the concepts and principles of new age transportation systems
CO2	Identify and describe the key components, technologies, and stakeholders in new age transportation.
CO3	Analyze and assess the benefits, challenges, and social, economic, and environmental implications of new age transportation systems
CO4	Evaluate the potential and limitations of emerging transportation technologies and trends.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	3	2
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	1	2
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	3	2
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2.5	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies
1	Understand the conSScept of new age transit systems and their distinguishing features in comparison to traditional transportation modes. Comprehend the impact of emerging trends, such as digitalization,	

	automation, and electrification, on the transportation sector. Understand the role of socioeconomic and environmental factors in shaping the need for innovative transportation solutions. C1 (Remember), C2 (Understanding) Apply the knowledge of new age transit systems to analyze real-world transportation scenarios. Apply the understanding of emerging trends and technologies to assess the feasibility and potential benefits of implementing new age transportation solutions. Apply the understanding of socioeconomic and environmental factors to evaluate the relevance and sustainability of new age transit systems in specific contexts. C3 (Application)
2	Understand the role and significance of each component and technology in ITS. Comprehend the various applications and benefits of traffic management systems in improving transportation efficiency and safety. Understand how intelligent infrastructure and vehicle-to-infrastructure communication contribute to the overall effectiveness of ITS. C1 (Remember), C2 (Understanding) Apply knowledge of ITS components and technologies to analyze and propose solutions for transportation challenges. Apply understanding of traffic management systems to develop strategies for optimizing traffic flow and reducing congestion. Apply knowledge of intelligent infrastructure and vehicle-to-infrastructure communication to design systems that enable effective information exchange and coordination in transportation networks. C3 (Application)
3	Understand the basic features and components of electric vehicle (EV) technology and infrastructure. Remember the fundamental concepts and models of shared mobility and Transportation as a Service (TaaS). Recall the implications and challenges associated with the adoption of electric and autonomous vehicles (EVs and AVs). C1 (Remember), C2 (Understanding) Evaluate the effectiveness of EV technology and infrastructure in reducing carbon emissions and promoting sustainable transportation. Evaluate the potential benefits and drawbacks of different models of shared mobility and TaaS in terms of efficiency and environmental impact. Assess the challenges and risks associated with the adoption of EVs and AVs from various perspectives, such as safety, infrastructure, and public acceptance. C5 (Evaluate)
4	Understand the different types of alternative fuels and energy sources available for transportation, such as biofuels, hydrogen, and electric power. Comprehend the principles and strategies involved in sustainable urban transportation planning and design, including transit-oriented development and non-motorized transportation. Understand the concept of multi-modal transportation systems and the importance of integrating different modes of transportation. C1 (Remember), C2 (Understanding)

	Analyze the environmental, economic, and social impacts of different alternative fuels and energy sources in transportation. Analyze urban transportation systems and infrastructure to identify opportunities for improvement in terms of sustainability and efficiency. Analyze the integration of different modes of transportation to assess the benefits and challenges of multi-modal systems. C4 (Analyze)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student’s Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Text Books 1. Intelligent Transportation Systems: Functional Design for Effective Traffic Management" by Asad Khattak and Luis F. Miranda-Moreno

	Reference Books 1. Autonomous Vehicles: Intelligent Transport Systems and Smart Technologies" by Felipe Jimenez and Ángel Iglesias 2. Shared Mobility and the Transformation of Public Transit" by Transit Cooperative Research Program (TCRP) 3. Sustainable Transportation Planning: Tools for Creating Vibrant, Healthy, and Resilient Communities" by Jeffrey Tumlin 4. Electric Vehicle Technology Explained" by James Larminie and John Lowry

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130108111
Course Title	**Earthquake Engineering**
Academic Year	IV
Semester	VIII
Number of Credits	3
Course Prerequisite	Soil Mechanics and Structural Engineering
Course Synopsis	Introduction to Dynamic Loads, Basics of Seismology, Behavior of Structures During Earthquake and Earthquake Resistant Features of Structure, Fundamentals of Earthquake Vibrations of Structures, Earthquake Load Analysis on Structures

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

CO1	To provide a coherent development to the students for the courses in sector of earthquake engineering
CO2	To present the foundations of many basic engineering concepts related earthquake engineering
CO3	To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
CO4	To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	2	1
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	2	1
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	2	1
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	2	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies
1	Acquire knowledge about dynamic loads and understand the difference between static and dynamic loads. Identify different types of dynamic forces	

	that act on structures. Learn about force control and displacement control in relation to dynamic loads. C1 (Remember), C2 (Understanding) Acquire knowledge about dynamic loads and understand the difference between static and dynamic loads. Identify different types of dynamic forces that act on structures. Learn about force control and displacement control in relation to dynamic loads. C3 (Application) Analyze the characteristics and effects of dynamic loads on structures. Evaluate the impact of dynamic loads on the stability, strength, and durability of structures. Analyze the behavior of structures under different types of dynamic forces. Differentiate between force control and displacement control approaches and their suitability in various structural applications. C4 (Analysis)
2	Acquire knowledge about the basics of seismology, including the Earth and its interior structure. Understand the concept of plate tectonics and the role of convection currents. Learn about earthquakes, including inter plate and intraplate earthquakes. Familiarize yourself with seismic waves, basic terminology, measuring units, and instruments used in seismology. C1 (Remember), C2 (Understanding) Apply the knowledge of seismology to analyze and interpret seismic data. Apply the principles of plate tectonics to understand the distribution of earthquakes around the world. Use measuring units and instruments to gather data and assess seismic activity in different regions. C3 (Application) Analyze the causes and effects of earthquakes in relation to plate boundaries. Analyze the characteristics of seismic waves and their propagation through the Earth's layers. Examine different types of faults and their role in generating earthquakes. Analyze seismic data to identify patterns and trends in earthquake occurrence. C4 (Analysis)
3	Acquire knowledge about the behavior of reinforced concrete (RC) structures during earthquakes. Understand the load transfer path in RC structures and the concept of strength hierarchy. Learn about the reversal of stresses and the importance of beam-column joints in seismic performance. Familiarize yourself with the significance of stiffness and ductility in structures, following the capacity design concept. Study the effects of various factors on RC structures, such as short columns, soft storeys, improper detailing, masonry infill walls, eccentricity, pounding, floating columns, flexibility, and setbacks. Identify earthquake-resistant features of RC structures. C1 (Remember), C2 (Understanding) Apply the knowledge of RC structures during earthquakes to analyze and evaluate the behavior of specific structural elements and systems. Apply the load transfer path concept to determine the distribution of forces within RC structures. Assess the strength hierarchy and the significance of beam-column joints in the seismic design of RC structures. Apply capacity design principles to ensure adequate stiffness and ductility in structural elements. Evaluate the effects of different factors on the seismic performance of RC structures, such as short columns, soft storeys, infill walls, eccentricity, and setbacks. C3 (Application)

4	Acquire knowledge about the equation of motion in mechanical systems. Understand the derivation of the equation of motion using Newton's Law and D'Alembert's Principle. Learn about degrees of freedom in mechanical systems. Familiarize yourself with the simplified single degree of freedom model. Study mathematical modeling techniques for mechanical systems. Understand the equations of motion for free vibration in damped and undamped single degree of freedom systems. Gain knowledge about the equations of motion for forced vibration in damped and undamped single degree of freedom systems. Learn about the logarithmic decrement and its significance in analyzing the damping characteristics of mechanical systems. C1 (Remember), C2 (Understanding) Apply the knowledge of equations of motion to analyze and solve problems related to mechanical systems. Apply Newton's Law and D'Alembert's Principle to derive the equation of motion for specific mechanical systems. Apply the concept of degrees of freedom to determine the number of independent coordinates required to describe the motion of a system. Apply the simplified single degree of freedom model to analyze the response of mechanical systems. Apply mathematical modeling techniques to represent the behavior of mechanical systems mathematically. Solve the equations of motion for free vibration in damped and undamped single degree of freedom systems to determine natural frequencies and mode shapes. Solve the equations of motion for forced vibration in damped and undamped single degree of freedom systems to analyze the response to external excitation. Apply the concept of logarithmic decrement to estimate the damping ratio of mechanical systems. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Peer Group activities	University End Term Examination
Quiz	

Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Textbooks 1. S. K. Duggal; Earthquake Resistance Design of Structures; Oxford University Press, New Delhi **Reference Books** 1. Earthquake Resistant Design of Structures By Pankaj Agarwal & Manish Shrikhande, PHI Publications 2. Manish Shrikhande & Pankaj Agrawal; Earthquake Resistant Design of Structures, PHI Publication, New Delhi 3. Clough & Penzin; Dynamics of Structures

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**River Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	
Course Synopsis	This course introduces students to the fundamental principles and engineering practices related to river systems. It covers the hydrology and hydraulics of rivers, sediment transport, river morphology, and the design of hydraulic structures such as weirs, barrages, and embankments. Emphasis is placed on river training works, flood control, and environmental aspects of river engineering. The course develops skills in analyzing river flow, sediment behavior, and applying river management strategies for sustainable development and flood mitigation.

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

CO1	Understand river characteristics, hydrology, and flow regimes in river engineering contexts.
CO2	Apply principles of open channel hydraulics and sediment transport to analyze river behavior.
CO3	Design river training structures and flood control measures using engineering standards.
CO4	Evaluate environmental and ecological impacts and apply integrated river basin management approaches.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	2	1
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	2	1
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	2	1
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	2	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	1

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	0	0	3

Unit	Content	Competencies

1	River systems are classified according to their origin, flow regimes, and channel characteristics, with hydrological processes governing the rainfall-runoff relationship and river discharge patterns. River morphology is influenced by factors such as sediment supply, flow velocity, and channel slope. Hydrographs and stage-discharge relationships describe river behavior over time. The understanding of river regimes is essential for assessing natural variability and planning engineering interventions (C2 – Understand, C3 – Apply).
2	Open channel flow dynamics include velocity distribution affected by channel shape, roughness, and flow conditions, which may be subcritical, critical, or supercritical. Gradually varied flow profiles describe changes along the river length, whereas rapidly varied flow conditions are present near hydraulic structures or natural obstacles. Application of energy and momentum equations facilitates the analysis and design of river hydraulics, crucial for controlling flow and managing sediment transport (C2 – Understand, C3 – Apply).
3	Sediment transport mechanisms involve bed load movement along the channel bed and suspended load carried within the flow. Sediment characteristics and transport rates affect riverbed forms, such as dunes and ripples, and influence channel stability. Morphological features such as meanders and braids arise from interactions between flow dynamics and sediment transport, resulting in erosion, deposition, and channel migration. River training works aim to stabilize banks and guide flow paths to reduce erosion and improve navigability (C2 – Understand, C3 – Apply, C4 – Analyze).
4	Hydraulic structures including weirs, barrages, embankments, and spurs regulate flow, facilitate water diversion, and protect against flooding. Flood routing and forecasting techniques support flood risk management through watershed planning and early warning systems. Environmental aspects focus on minimizing ecological disruption, maintaining sediment balance, and promoting sustainable management of river basins using integrated approaches that consider social, economic, and environmental factors (C3 – Apply, C4 – Analyze).

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	2. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

References:	
	Textbooks Subramanya, K., River Engineering, McGraw Hill Education. Chow, V.T., Open Channel Hydraulics, McGraw Hill. Vanoni, M., Sedimentation Engineering, ASCE Manuals and Reports on Engineering Practice.

Course for Specialization

Structural Engineering

Structural Dynamics	3	0	0	3
Structural Dynamics Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130108115
Course Title	**Structural Dynamics**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	Structure Analysis, Engineering Mechanics
Course Synopsis	Structural Dynamics is a course that focuses on the analysis and behavior of structures under dynamic loads. The course introduces students to the fundamental concepts and principles of structural dynamics, including vibration analysis, response of structures to dynamic loads, and the dynamic behavior of single and multi-degree-of-freedom systems. Students will learn various analytical techniques and methods to model, analyze, and design structures subjected to dynamic forces.

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

CO1	Understand the basic principles and concepts of structural dynamics.
CO2	Analyze the dynamic behavior of single and multi-degree-of-freedom systems.
CO3	Identify different types of dynamic loads and their effects on structures.
CO4	Utilize computer software for structural dynamics analysis.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	3	2
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	3	2
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	3	2
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	3	2

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Define & understand the fundamental principles and theories of structural dynamics. Comprehend the meaning and significance of various terms and concepts related to structural dynamics. Explain the different types of dynamic loads and their effects on structures. Understand why	

	structural dynamics is essential in engineering. C1 (Remember), C2 (Understanding) Apply the appropriate terminology and concepts of structural dynamics when discussing and designing structures. Apply the knowledge of different types of dynamic loads to evaluate their impact on the behavior and performance of structures. C3 (Application)
2	Understand the characteristics and behavior of single degree of freedom systems during free vibration. Comprehend how single degree of freedom systems respond to harmonic excitation and transient excitation. Understand the fundamentals of multi-degree of freedom systems. Understand the concept of modal analysis and its application in analyzing the behavior of multi-degree of freedom systems. Understand the equations of motion and eigenvalue problems associated with multi-degree of freedom systems. C1 (Remember), C2 (Understanding) Analyze the free vibration response of single degree of freedom systems using appropriate methods and techniques. Analyze the response of single degree of freedom systems subjected to harmonic excitation and transient excitation. Analyze the dynamic behavior of multi-degree of freedom systems using modal analysis. Analyze the equations of motion and eigenvalue problems to determine the natural frequencies and mode shapes of multi-degree of freedom systems. C4 (Analyze)
3	Understand how free vibration analysis is performed using matrix methods. Comprehend the process of forced vibration analysis using matrix methods. Understand the concept of mode superposition and its application in vibration analysis. C1 (Remember), C2 (Understanding) Analyze the vibration characteristics of continuous systems, such as strings, bars, beams, and plates. Analyze the behavior of these systems under different boundary conditions and loading scenarios. Analyze the natural frequencies, mode shapes, and response of continuous systems to vibrations. C4 (Analyze)
4	Understand the principles of dynamic analysis for structures. Comprehend the role of damping in modifying the structural response to dynamic loads. Understand how response spectrum analysis is used to assess the dynamic behavior of structures. Understand the behavior of reinforced concrete structures under dynamic loading conditions. Understand the design considerations that need to be taken into account for dynamic loads. C1 (Remember), C2 (Understanding) Analyze the dynamic response of structures considering various factors such as material properties, structural geometry, and loading conditions. Analyze the influence of damping on the structural response and its effect on the overall behavior of the structure. Analyze response spectra to determine the peak responses of structures to specific ground motions. Analyze the behavior of reinforced concrete structures under dynamic loads and identify potential failure modes. C4 (Analyze)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	27
Practical	--
Seminar/Journal Club	4
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. Dynamics of Structures" by Anil K. Chopra **Reference Books** 1. Structural Dynamics: An Introduction to Computer Methods" by Roy R. Craig Jr. and Andrew J. Kurdila 2. "Structural Dynamics: Theory and Applications" by Joseph W. Tedesco, William G. McDougal, and C. Allen Ross 3. "Vibration Analysis for Structural Dynamics" by Jorge Rodriguez and William Leigh

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Structural Dynamics Lab**
Academic Year	III
Semester	VII
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The Structural Dynamics Lab is designed to provide hands-on experience in dynamic testing and analysis of structural elements. Through various experiments, students will measure vibration responses, determine dynamic parameters, and evaluate structural behavior under dynamic loads such as impact, cyclic, and harmonic forces. The lab also emphasizes the use of data acquisition systems, signal processing, and interpretation of time- and frequency-domain results for practical civil engineering applications like earthquake response, machine foundation design, and damping systems.

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

CO1	Understand and measure dynamic properties of structures such as natural frequency, damping ratio, and mode shapes.
CO2	Perform vibration experiments and analyze structural response under different loading conditions.
CO3	Apply signal processing tools to interpret time-history and frequency response data.
CO4	Evaluate dynamic behavior of beams, frames, and scaled models for practical applications in structural design and retrofitting.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	0	2	2

Experiment No.	Content

1.	Determination of natural frequency of a simply supported beam using FFT analyzer
2.	Free vibration test to determine damping ratio of a cantilever beam
3.	Harmonic excitation and resonance observation in a single degree of freedom system
4.	Forced vibration test on a spring-mass-damper system
5.	Evaluation of transmissibility and isolation efficiency of a vibration isolator
6.	Impact hammer test and modal analysis using accelerometers and data acquisition
7.	Time-history response analysis of a structure using simulation software
8.	Earthquake response analysis of a scaled frame model on a shake table
9.	Response of a base-isolated model compared to a fixed-base model
10.	Mini project: Dynamic behavior comparison of different structural forms/materials

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system **2.** Feedback between the semester through google forms	

Course for Specialization

Green Technology and Sustainable Engineering

Water and Waste Management for Sustainable Development	3	0	0	3
Water and Waste Management for Sustainable Development Lab	0	0	2	1

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Water and Waste Management for Sustainable Development**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course provides a comprehensive understanding of integrated water and waste management strategies with a focus on sustainability. It emphasizes the importance of conserving water resources, recycling wastewater, managing solid and liquid waste effectively, and aligning with national and global sustainability goals. Students will learn about decentralized systems, reuse strategies, policy frameworks, and innovative technologies for water and waste management in urban and rural contexts.

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

CO1	Understand the principles of water and waste management in the context of sustainable development.
CO2	Apply techniques for water conservation, reuse, and efficient waste handling.
CO3	Analyze the impact of waste and water mismanagement on environment and health
CO4	Evaluate sustainable water and waste solutions using circular economy and lifecycle thinking.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-

Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3	**0**	**0**	**3**

Unit	Content	Competencies
1	Overview of sustainable development goals (SDGs) related to water and sanitation (C2 – Understand). Fundamentals of integrated water resource management (IWRM) and circular economy (C2 – Understand). Sources and classification of water and waste in urban and rural areas (C3 – Apply).	
2	Rainwater harvesting systems and design approaches (C3 – Apply). Greywater recycling techniques and decentralized treatment systems (C3 – Apply). Efficient water use in domestic, agricultural, and industrial sectors (C4 – Analyze). Water-sensitive urban design (WSUD) and low-impact development (C4 – Analyze).	
3	Types, sources, and characteristics of municipal solid waste (MSW), biomedical and industrial waste (C2 – Understand). Collection, segregation, recycling, composting, and waste-to-energy options (C3 – Apply). Sewage and faucal sludge treatment technologies (C3 – Apply). Leachate management and landfill design (C4 – Analyze).	
4	National and international regulations (SWM Rules 2016, AMRUT, SBM, etc.) (C2 – Understand). Lifecycle analysis of waste systems and performance indicators (C4 – Analyze). Public-private partnerships, stakeholder engagement, and behavior change for sustainability (C3 – Apply). Smart waste and water management using ICT and IoT tools (C4 – Analyze).	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--

Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

AssessFeedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. **Peavy, H.S., Rowe, D.R., Tchobanoglous, G., Environmental Engineering, McGraw Hill** 2. **B.C. Punmia, Environmental Engineering (Vol. I & II), Laxmi Publications**

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Water and Waste Management for Sustainable Development Lab**
Academic Year	III
Semester	VII
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab course offers hands-on experience in analyzing the quality of water and waste samples, designing small-scale waste management systems, and applying tools for sustainable assessment. Students will perform standard water/wastewater quality tests, evaluate treatment methods, and use sustainability tools such as lifecycle analysis and waste audits for informed decision-making.

Course Outcomes:

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

CO1	Perform laboratory testing of water and wastewater parameters to assess quality.
CO2	Apply basic techniques for designing rainwater harvesting, composting, and waste reuse systems.
CO3	Analyze results from waste and water audits for sustainability assessment.
CO4	Evaluate the efficiency of decentralized treatment and recycling solutions using lab-scale models.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**

Experiment No.	**Content**
1.	Determination of pH, turbidity, TDS, and hardness of water
2.	Determination of BOD and COD of wastewater samples
3.	Analysis of nitrate, phosphate, and heavy metals in water or leachate samples
4.	Design of a rooftop rainwater harvesting system
5.	Laboratory demonstration of greywater recycling using sand filter/anaerobic units
6.	Composting of organic waste and observation of degradation parameters
7.	Leachate collection and analysis from a mini landfill model
8.	Conducting a household/hostel waste audit
9.	Use of sustainability indicators (WATER-E, SWM Index) for evaluating a locality
10.	Project report on sustainable water and waste management practices in a community

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	**Summative**

Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce
Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

Course for Specialization

Construction Technology

Prefabrication and Modular Construction	3	0	0	3
Prefabrication and Modular Construction Lab	0	0	2	1

Faculty of Engineering & Technology		
Name of the Department	Civil Engineering	
Name of the Program	Bachelor of Technology	
Course Code		
Course Title	**Prefabrication and Modular Construction**	
Academic Year	IV	
Semester	VII	
Number of Credits	3	
Course Prerequisite	NIL	
Course Synopsis	This course introduces students to the planning, design, production, and implementation of prefabricated and modular building systems. Emphasis is placed on construction methods, structural connections, logistics, and on-site assembly. Students will also explore the economic, environmental, and technological aspects that make prefabrication and modular construction essential to rapid, sustainable, and cost-effective civil engineering solutions.	

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

CO1	Understand the principles, types, and components of prefabricated and modular systems.
CO2	Apply design and planning techniques for modular coordination and standardization.
CO3	Analyze manufacturing, transportation, and assembly processes of prefabricated elements.
CO4	Evaluate the feasibility, performance, and sustainability of modular construction systems.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

<table>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>L (Hours/Week)</td><td>T (Hours/Week)</td><td>P (Hours/Week)</td><td>Total Hour/Week</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

<table>
<tr><td>Unit</td><td>Content</td><td>Competencies</td></tr>
<tr><td>1</td><td colspan="2">Definition, scope, and historical development of prefabrication; difference between precast, prefabrication, and modular construction (C2 – Understand). Advantages and challenges including speed, cost, quality control, and sustainability (C2 – Understand). Classification: panelized, volumetric, hybrid, and modular systems (C3 – Apply).</td></tr>
<tr><td>2</td><td colspan="2">Modular coordination principles, dimensional standardization, and structural module planning (C3 – Apply). Design for disassembly, transportation, and lifting (C3 – Apply). Joints and connections in modular systems—dry and wet joints, mechanical fasteners, adhesives, and welding techniques (C4 – Analyze).</td></tr>
<tr><td>3</td><td colspan="2">Production and casting techniques for walls, slabs, beams, staircases, and volumetric units (C3 – Apply). Storage, handling, and transportation logistics (C3 – Apply). Erection methods using cranes, sequencing, and on-site assembly procedures (C4 – Analyze). Tolerances, quality control, and defect management (C4 – Analyze).</td></tr>
<tr><td>4</td><td colspan="2">Thermal, acoustic, and structural performance of prefabricated buildings (C4 – Analyze). Environmental benefits and embodied energy considerations (C4 – Analyze). Building codes and standards (IS codes, ISO, BS) related to modular construction (C2 – Understand). National and international case studies on housing, commercial, and industrial projects (C4 – Analyze).</td></tr>
</table>

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**

Peer Group activities	University End Term Examination
Quiz	
Seminars	
Problem Based Learning (PBL)/Assignments	
Comprehensive assessment	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Peer Group activities	✓	✓	✓	✓
Quiz	✓	✓	✓	✓
Seminars	✓	✓	✓	✓
Problem Based Learning (PBL)/Assignments	✓	✓	✓	✓
Comprehensive assessment	✓	✓	✓	✓
University End Term Examination	✓	✓	✓	✓

Assessment Feedback Process	1. Student's Feedback
Students Feedback is taken through various steps 1. Regular feedback through Mentor Mentee system 2. Feedback between the semester through google forms	
References:	
	Text Books 1. **G.S. Ramaswamy, Modern Building Construction, Dhanpat Rai Publishing** 2. **C. Bjork, Industrialized Building: Integrated Systems, Applied Science Publishers** 3. **IS 15916:2010 – Building Design and Erection Using Prefabricated Concrete** 4. **Reports and manuals from BMTPC, CPWD, and GRIHA on modular construction**

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Prefabrication and Modular Construction Lab**
Academic Year	IV
Semester	VII
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	This lab course provides practical exposure to the design, casting, and assembly of prefabricated structural elements and modular units. Students will learn about construction joint detailing, lifting and fixing methods, and modular layout planning. Through mini-projects and scaled prototypes, the lab emphasizes collaboration, sustainability, and design innovation in industrialized building systems.

Course Outcomes:

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

CO1	Identify and demonstrate various prefabricated construction components and systems.
CO2	Design and simulate modular layouts using coordination principles.
CO3	Fabricate small-scale prefabricated elements and test joint behavior
CO4	Evaluate erection procedures, quality control measures, and system efficiency.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:			
L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**

0	0	2	2

Experiment No.	Content
1.	Identification and demonstration of prefabricated wall panels and structural components
2.	Preparation of a modular layout plan for a housing unit
3.	Casting of a precast slab or beam (small-scale model)
4.	Testing of joints: bolted, dowel, and keyed joints for strength and performance
5.	Simulation of lifting and placing prefabricated elements using crane models
6.	Measurement and adjustment of tolerances in precast elements
7.	Site layout and erection sequence planning for modular components
8.	Demonstration of lightweight panels and connections for rapid housing
9.	Quality checks and defect identification in precast components
10.	Mini-project: Design, fabricate, and assemble a small prefabricated room/module

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	12
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	8
Revision	--
Others If any:	--
Total Number of Contact Hours	30

Assessment Methods:

Formative	Summative
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	Practical Examination & Viva-voce

Viva-Voce/Quiz/Lab Test	
Logbook/Record/Documentation	

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
Practical/Lab/Clinical Proficiency (Laboratory/Workshop Performance)	✓	✓	✓	✓
Viva-Voce/Quiz/Lab Test	✓	✓	✓	✓
Logbook/Record/Documentation	✓	✓	✓	✓
Practical Examination & Viva-voce	✓	✓	✓	✓

Feedback Process	1. Student's Feedback

Students Feedback is taken through various steps

1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms

SEMESTER - VIII

Course Code	Course Title
	Industrial Internship