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Faculty of Engineering & Technology

Civil Engineering Department

4 Year Full Time Education Program

B.Tech. Civil Engineering

With effect from Year 2023

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Head of the Department Dean

Dean – Academics

1. NATURE AND EXTENT OF THE PROGRAM

B.Tech. (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 B.Tech. Civil Engineering program:

Curriculum: The curriculum of a B.Tech. 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: B.Tech. 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 B.Tech. 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 B.Tech. 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: B.Tech. 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, B.Tech. 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.

B.Tech. 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 B.Tech. Civil Engineering programs:

Classroom Lectures: Traditional classroom lectures are a common mode of teaching in B.Tech. 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: B.Tech. 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, B.Tech. 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 B.Tech. 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 B.Tech. 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: B.Tech. 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 B.Tech. 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 B.Tech. 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 B.Tech. Civil Engineering:

Knowledge Base: Graduates of B.Tech. 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	Development of professional skills in the area of Structural Engineering, Water Resources Engineering, Transportation Engineering, Environmental Engineering, Geotechnical Engineering, Geo-informatics & Remote sensing, and Construction techniques & management
PSO2	Application of relevant aspects of mathematics in engineering analysis and design.
PSO3	Application of these principles and practices to problems related to Civil Engineering and other allied technical & industrial fields.
PSO4	Work as design consultants in construction industry for the design of civil engineering structures.

7. COURSE STRUCTURE

SEMESTER – I

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**IAE**	**ESE**	**Total**
	Engineering Mathematics-I	3	0	0	3	**40**	**60**	**100**
	Programming for Problem Solving	2	0	0	2	**40**	**60**	**100**
	Programming for Problem Solving Lab	0	0	4	2	**60**	**40**	**100**
	Engineering Workshop	1	0	0	1	**40**	**60**	**100**
	Engineering Workshop Lab	0	0	4	2	**60**	**40**	**100**
	Design Thinking	0	0	4	2	**60**	**40**	**100**
	MGE-1	4	0	0	4	**40**	**60**	**100**
	VASE-1	2	0	0	2	**20**	**30**	**50**
	AECC-1	2	0	0	2	**20**	**30**	**50**
	Total	14	0	12	**20**	**380**	**420**	**800**

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

SEMESTER – II

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**IAE**	**ESE**	**Total**
	Engineering Mathematics-II	3	0	0	3	**40**	**60**	**100**
	Basics of Electrical & Electronics Engineering	2	0	0	2	**40**	**60**	**100**
	Basics of Electrical & Electronics Engineering Lab	0	0	4	2	**60**	**40**	**100**
	Engineering Graphics and Design	1	0	0	1	**40**	**60**	**100**
	Engineering Graphics and Design Lab	0	0	4	2	**60**	**40**	**100**
	New Age Skills	0	0	4	2	**60**	**40**	**100**
	MGE-2	4	0	0	4	**40**	**60**	**100**
	VASE-2	2	0	0	2	**20**	**30**	**50**
	AECC-2	2	0	0	2	**20**	**30**	**50**
	Total	14	0	12	**20**	**380**	**420**	**800**

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

SEMESTER – III

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**IAE**	**ESE**	**Total**
	Strength of materials	3	0	0	3	**40**	**60**	**100**
	Strength of materials Lab	0	0	2	1	**60**	**40**	**100**
	Surveying	2	0	0	2	**40**	**60**	**100**
	Surveying Lab	0	0	4	2	**60**	**40**	**100**
	Building Construction & Material	2	0	0	2	**40**	**60**	**100**
	MGE-3	4	0	0	4	**40**	**60**	**100**
	VASE-3	2	0	0	2	**20**	**30**	**50**
	AECC-3	2	0	0	2	**20**	**30**	**50**
	Summer Internship	0	0	2	1	**60**	**40**	**100**
Program Elective-I Pool (Choose One from the pool)								
	Civil Infrastructure and Society	3	0	0	3	**40**	**60**	**100**
	Structural Mechanics							
	Introduction to Sustainable development							
	Air, Noise Pollution and Control							
	Total	18	0	8	**22**	**420**	**480**	**900**
Additional Credits For Specialization Artificial Intelligence & Data Science								
	Introduction To Data Science	3	0	0	3	**40**	**60**	**100**
	Introduction To Data Science LAB	0	0	2	1	**60**	**40**	**100**
	Total with specialization	21	0	10	**26**	**520**	**580**	**1100**

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

SEMESTER – IV

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**IAE**	**ESE**	**Total**
	Structural Analysis	3	0	0	3	**40**	**60**	**100**
	Fluid Mechanics	3	0	0	3	**40**	**60**	**100**
	Fluid Mechanics Lab	0	0	2	1	**60**	**40**	**100**
	Concrete technology	3	0	0	3	**40**	**60**	**100**
	Concrete technology Lab	0	0	2	1	**60**	**40**	**100**
	Civil Engineering Drawing Lab	0	0	4	2	**60**	**40**	**100**
	VASE-4	2	0	0	2	**20**	**30**	**50**
	AECC-4	2	0	0	2	**20**	**30**	**50**
Program Elective-II Pool (Choose One from the pool)								
	Advanced Surveying	3	0	0	3	**40**	**60**	**100**
	Environment impact assessment							
	Engineered Systems and Sustainability							
	Introduction to AI and Data Analytics for Civil Engineering							
Total		16	0	8	**20**	**380**	**420**	**800**
Additional Credits For Specialization Artificial Intelligence & Data Science								
	Data analysis using Python	3	0	0	3	**40**	**60**	**100**
	Data analysis using Python Lab	0	0	2	1	**60**	**40**	**100**
Total with specialization		19	0	10	**24**	**480**	**520**	**900**

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

SEMESTER – V

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
	Reinforced Concrete Structures-I	3	1	0	4	**40**	**60**	**100**
	Hydrology	3	0	0	3	**40**	**60**	**100**
	Soil Mechanics	3	0	0	3	**40**	**60**	**100**
	Soil Mechanics Lab	0	0	2	1	**60**	**40**	**100**
	Engineering Geology	3	0	0	3	**40**	**60**	**100**
	BIM Lab	0	0	4	2	**60**	**40**	**100**
	Industrial Training - I / MOOC Course	0	0	2	1	**60**	**40**	**100**
	Personality Development & Career Building	2	0	0	-	**-**	**-**	**-**
Program Elective-III Pool (Choose One from the pool)								
	Advanced Structural Analysis	3	0	0	3	**40**	**60**	**100**
	Open channel flow							
	Disaster Control and Management							
	Earth and Environment							
	Total	17	1	8	**20**	**380**	**420**	**800**
Additional Credits For Specialization Artificial Intelligence & Data Science								
	Introduction to AI and ML	3	0	0	3	**40**	**60**	**100**
	Introduction to AI and ML Lab	0	0	2	1	**60**	**40**	**100**
	Total with specialization	20	1	10	**24**	**480**	**520**	**1000**

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

SEMESTER – VI

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
	Design of Steel Structures-I	3	1	0	4	**40**	**60**	**100**
	Water Treatment & Supply Systems	3	0	0	3	**40**	**60**	**100**
	Water Treatment & Supply Systems Lab	0	0	2	1	**60**	**40**	**100**
	Highway Engineering	3	0	0	3	**40**	**60**	**100**
	Highway Engineering Lab	0	0	2	1	**60**	**40**	**100**
	Geo-Technology	3	0	0	3	**40**	**60**	**100**
	Design Lab	0	0	4	2	**60**	**40**	**100**
	Quantitative Aptitude & Logical Reasoning	2	0	0	-	**-**	**-**	**-**
Program Elective-IV Pool (Choose One from the pool)								
	Reinforced Concrete Structures-II	3	0	0	3	**40**	**60**	**100**
	Construction Safety							
	Energy Efficient Structure							
	Introduction to Smart Cities							
Total		17	1	8	**20**	**380**	**420**	**800**
Additional Credits For Specialization Artificial Intelligence & Data Science								
	Data Mining	3	0	0	3	**40**	**60**	**100**
	Data Mining Lab	0	0	2	1	**60**	**40**	**100**
Total with specialization		20	1	10	**24**	**480**	**520**	**1000**

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

SEMESTER – VII

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
	Irrigation Engineering	3	0	0	3	**40**	**60**	**100**
	Estimation & Costing	3	0	0	3	**40**	**60**	**100**
	Construction Project Management	2	0	0	2	**40**	**60**	**100**
	Construction Project Management Lab	0	0	4	2	**60**	**40**	**100**
	Capstone Project	0	0	4	2	**60**	**40**	**100**
	Valuation & Costing Lab	0	0	4	2	**60**	**40**	**100**
	Industrial Training - II	0	0	2	1	**60**	**40**	**100**
Program Elective-V (Choose One from the pool)								
	Bridge Engineering	3	0	0	3	**40**	**60**	**100**
	Ground water engineering							
	Railways, Tunnel and Airport Engineering							
	Waste water treatment							
	Total	11	0	14	**18**	**400**	**400**	**800**
Additional Credits For Specialization Artificial Intelligence & Data Science								
	Data Visualization	3	0	0	3	**40**	**60**	**100**
	Data Visualization Lab	0	0	2	1	**60**	**40**	**100**
	Total with specialization	14	0	16	**22**	**500**	**500**	**1000**

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

SEMESTER – VIII

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	**T**	**P**	**C**	**IAE**	**ESE**	**Total**
	Earthquake Engineering	3	0	0	3	**40**	**60**	**100**
	Entrepreneurship & Digital Product Management	0	0	4	2	**60**	**40**	**100**
	Simulation Lab	0	0	4	2	**60**	**40**	**100**
	Research Project/ Dissertation	0	0	20	10	**60**	**40**	**100**
Program Elective-VI(Choose One from the pool)								
	Structural Dynamics	3	0	0	3	**40**	**60**	**100**
	Stochastic Hydrology							
	New Age Transit System							
	Urban environmental quality Management							
	Total	6	0	28	**20**	**260**	**240**	**500**

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

Multidisciplinary Generic Electives (MGE)
Multidisciplinary Generic Electives is credited and choice-based. The students make a choice from a pool of MGE 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 Compulsory Course (AEC)
Ability Enhancement Compulsory 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)
Ability Enhancement Compulsory Courses are credited and choice-based. The students make a choice from the pool of AEC offered by the Faculty under the University.

Semester III, Semester V & Semester VII

Internship

Semester	Scheme	Duration
Semester III	Summer Internship	2 Weeks After Semester II
Semester V	Industrial Training-I	4 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	IAE	ESE	Total
SEMESTER – I	14	0	12	**20**	**380**	**420**	**800**
SEMESTER – II	14	0	12	**20**	**380**	**420**	**800**
SEMESTER – III	18	0	8	**22**	**420**	**480**	**900**
SEMESTER – IV	16	0	8	**20**	**380**	**420**	**800**
SEMESTER – V	17	1	8	**20**	**380**	**420**	**800**
SEMESTER – VI	15	1	8	**20**	**380**	**420**	**800**
SEMESTER – VII	11	0	14	**18**	**400**	**400**	**800**
SEMESTER – VIII	6	0	28	**20**	**260**	**240**	**500**
Total	**113**	**2**	**98**	**160**	**2980**	**3220**	**6200**

Note – L: Lecture Hour, T: Tutorial Hour, P: Practical Hour, TC: Total Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination.

OVERALL CREDIT DISTRIBUTION TABLE (With Specialization)

SEMESTER	**HOURS PER WEEK**			**Total Credit**	**Marks Distribution**		
	L	T	P	TC	IAE	ESE	Total
SEMESTER – I	14	0	12	**20**	**380**	**420**	**800**
SEMESTER – II	14	0	12	**20**	**380**	**420**	**800**
SEMESTER – III	21	0	10	**26**	**520**	**580**	**1100**
SEMESTER – IV	19	0	10	**24**	**480**	**520**	**900**
SEMESTER – V	20	1	10	**24**	**560**	**590**	**1150**
SEMESTER – VI	20	1	10	**24**	**540**	**560**	**1100**
SEMESTER – VII	14	0	16	**22**	**560**	**540**	**1100**
SEMESTER – VIII	6	0	28	**20**	**260**	**240**	**500**
Total	**128**	**2**	**92**	**181**	**3590**	**3810**	**7200**

Note – L: Lecture Hour, T: Tutorial Hour, P: Practical Hour, TC: Total Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination.

8. SEMESTER-WISE COURSE DETAILS

SEMESTER - I

Course Code	Course Title
	Engineering Mathematics-I
	Programming for Problem Solving
	Programming for Problem Solving Lab
	Engineering Workshop
	Engineering Workshop Lab
	Design Thinking
	MGE-1
	VASE-1
	AECC-1

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Engineering Mathematics - I**
Academic Year	I
Semester	I
Number of Credits	4
Course Prerequisite	High School Mathematics
Course Synopsis	The concepts of mathematics-I are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics.

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

CO1	Use essential tools of matrices & eigen values
CO2	Understand the concept of Orthogonalization.
CO3	Solve the problems of Linear algebra including linear transformations
CO4	Solve the problems Laplace Transformation and its Application

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**
CO1	**3**	**3**	**3**	**3**	**2**							**1**
CO2	**3**	**3**	**3**	**3**	**2**							**1**
CO3	**3**	**3**	**3**	**3**	**2**							**1**
CO4	**3**	**3**	**3**	**3**	**2**							**1**
Average	**3**	**3**	**3**	**3**	**2**							**1**

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**1**	**0**	**4**

Unit	**Content**	**Competencies**
1 **Matrix Operation**	Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, Linear Independence, rank of a matrix; inverse of a matrix, Symmetric, skew-	C1 C3

	symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors, eigen bases; Diagonalization of matrices.	
2 **Orthogonalization.**	Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms. Cramer's Rule, Gauss elimination and Gauss-Jordan elimination, Gram-Schmidt orthogonalization.	C1 C3
3 **Linear Transformation**	Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.	C1 C3
4 **Laplace Transformation**	Laplace Transforms & Inverse Laplace Transforms; Solution based on Definition, change of scale property, 1^{st}& 2^{nd} shifting properties, LT division by t, LT of derivative, LT by multiplication by t, Convolution & application on LT & Inverse LT.	C1 C3

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	24
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	13
Problem Based Learning (PBL)	11
Case/Project Based Learning (CBL)	--
Revision	4
Others If any:	--
Total Number of Contact Hours	52

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005. 2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005. **Reference Books** 1.Linear Algebra, K. Hoffman, R Kunze, Pearson Publication 2. Engineering Mathematics, NP Bali, S Chand publication 3. Engineering Mathematics, B S Garewal, Khanna Publication

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Programming for Problem Solving**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	Basic Knowledge of Computers
Course Synopsis	This course let you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

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

CO1	To formulate simple algorithms for arithmetic and logical problems.
CO2	To translate the algorithms to programs (in C language).
CO3	To test and execute the programs and correct syntax and logical errors.
CO4	To implement conditional branching, iteration and recursion.
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO6	To use arrays, pointers and structures to formulate algorithms and programs.

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
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**		**3**	**3**				**3**	**2**		
CO3		**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**				
CO5	**3**	**3**	**3**	**3**		**3**		**2**				
CO6	**3**	**3**	**3**	**3**	**2**	**1**	**2**					
Average	**2.5**	**3**	**2.5**	**3**	**1.3**	**1.5**	**0.3**	**0.6**	**0.5**	**0.3**		

Course Content:

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

Unit	Content	Competencies
1	Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and	C1 C2 C3

	numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code ,Arithmetic expressions and precedence.	
2	Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms.	C1 C2 C3
3	Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Finding roots of equations, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Quick sort.	C1 C2 C3 C4
4	Structures, Defining structures and Array of Structures Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)	C1 C2 C3

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	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	26

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2

Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						
VIVA	▯	▯				
Assignment / Presentation	▯	▯	▯	▯	▯	▯
Unit test	▯	▯	▯	▯	▯	▯
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯	▯	▯
Mid Semester Examination 2	▯	▯	▯	▯	▯	▯
University 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 (i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill (ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Programming for Problem Solving Lab**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	Basic Computer Knowledge
Course Synopsis	This course let you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems .

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

CO1	To learn the syntax and semantics of Python programming language
CO2	To use the structural programming approach in solving the problem.
CO3	To use the object-oriented programming approach in solving problems
CO4	To handle exceptions gracefully
CO5	To develop searching and sorting algorithms 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**
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**	**3**	**3**	**3**				**3**	**2**	**3**	
CO3	**3**	**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**			**3**	
CO5	**3**	**3**	**3**	**3**		**3**		**2**			**1**	
Average	**3**	**3**	**3**	**3**	**1.2**	**1.6**		**0.8**	**0.6**	**0.4**	**1.4**	

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**4**	**2**

Experiment No.	**Content**	**Competencies**
1.	Develop programs to implement list.	C3, C4, C6
2.	Develop programs to implement Dictionary	C3, C4, C6
3.	Develop programs to implement tuples	C3, C4, C6
4.	Develop programs to understand the control structures of python	C3, C4, C6
5.	Develop programs to implement function with stress on scoping	C3, C4, C6

6.	Develop programs to implement classes and objects	C3, C4, C6
7.	Develop programs to implement exception handling.	C3, C4, C6
8.	Develop programs to implement linear search and binary search.	C3, C4, C6
9.	Develop programs to implement insertion sort	C3, C4, C6
10.	Develop programs to implement bubble sort.	C3, C4, C6
11.	Develop programs to implement quick sort.	C3, C4, C6
12.	Develop programs to implement heap sort.	C3, C4, C6

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	6
Problem Based Learning (PBL)	16
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	52

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA	☐	☐	☐	☐	☐	
Assignment / Presentation						

Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐	☐	
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 (Civil Engineering)**
Course Code	
Course Title	**Engineering Workshop**
Academic Year	I
Semester	I
Number of Credits	1
Course Prerequisite	
Course Synopsis	This course let you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

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

CO1	To formulate simple algorithms for arithmetic and logical problems.
CO2	To translate the algorithms to programs (in C language).
CO3	To test and execute the programs and correct syntax and logical errors.
CO4	To implement conditional branching, iteration and recursion.
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO6	To use arrays, pointers and structures to formulate algorithms and programs.

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
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**		**3**	**3**				**3**	**2**		
CO3		**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**				
CO5	**3**	**3**	**3**	**3**		**3**		**2**				
CO6	**3**	**3**	**3**	**3**	**2**	**1**	**2**					
Average	**2.5**	**3**	**2.5**	**3**	**1.3**	**1.5**	**0.3**	**0.6**	**0.5**	**0.3**		

Course Content:

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

Unit	Content	Competencies
1	Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and	C1 C2 C3

	numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code,Arithmetic expressions and precedence.	
2	Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms.	C1 C2 C3
3	Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Finding roots of equations, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Quick sort.	C1 C2 C3 C4
4	Structures, Defining structures and Array of Structures Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)	C1 C2 C3

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	2
Problem Based Learning (PBL)	12
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	39

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2

Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						
VIVA	☐	☐				
Assignment / Presentation	☐	☐	☐	☐	☐	☐
Unit test	☐	☐	☐	☐	☐	☐
Practical Log Book/ Record Book				☐	☐	☐
Mid Semester Examination 1	☐	☐	☐	☐	☐	☐
Mid Semester Examination 2	☐	☐	☐	☐	☐	☐
University 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 (i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill (ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Engineering Workshop Lab**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	
Course Synopsis	Workshop technology deals with different processes by which components of a machine or equipment are made. The subject aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components and articles.

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

CO1	Gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
CO2	Fabricate components with their own hands.
CO3	Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes. Also, able to study and analyse different electrical signals.
CO4	Gain Knowledge of the basics of electrical & electronics circuits and able to design their own components.

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**
CO1	**3**	**3**	**3**	**3**	**2**							
CO2	**3**	**3**	**3**	**3**	**2**							
CO3	**3**	**3**	**3**	**3**	**2**							
CO4	**3**	**3**	**3**	**3**	**2**							
Average	**3**	**3**	**3**	**3**	**2**							

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**4**	**2**

Experiment No.	**Content**	**Competencies**
1.	To study different types of measuring tools used in metrology and determine the least counts of vernier calipers, micrometers and vernier height gauges.	C1, C2, C3, C4
2.	To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off	C3, C4, C6

3.	To study different types of fitting tools and marking tools used in fitting practice.	C1, C2, C3, C4
4.	To prepare a layout on a metal sheet by making and prepare rectangular tray pipe-shaped components e.g., funnel.	C3, C4, C6
5.	To prepare joints for welding suitable for butt welding and lap welding.	C3, C4, C6
6.	To study various types of carpentry tools and prepare simple types of at least two wooden joints.	C1, C2, C3, C4, C6
7.	Measurement of voltage and current by multimeter and perform testing of various components.	C3, C4, C6
8.	To study cathode ray oscilloscope and perform measurements for a different signal.	C3, C4, C6
9.	To study 1) Safety precaution. 2) Electrical safety devices & protection like MCB, ELCB and Fuse.	C3, C4, C6
10.	To prepare of wiring diagram 1) Ceiling fan and Tube light 2) Two-way control switch.	C3, C4, C6
11.	To study the breadboard and PCB connection for Electronics circuit	C3, C4, C6
12.	To study soldering and de-soldering techniques for Electronics circuits.	C3, C4, C6
13.	To study different case studies using Arduino.	

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)	--
Case/Project Based Learning (CBL)	32
Revision	--
Others If any:	--
Total Number of Contact Hours	52

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1

Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA	□	□	□	□		
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	□	□	□	□		
Demonstration	□	□	□	□		
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	□	□	□	□		
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 - II

Course Code	Course Title
	Engineering Mathematics-II
	Basics of Electrical & Electronics Engineering
	Basics of Electrical & Electronics Engineering Lab
	Engineering Graphics and Design
	Engineering Graphics and Design Lab
	New Age Skills
	MGE-2
	VASE-2
	AECC-2

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Engineering Mathematics-II**
Academic Year	I
Semester	II
Number of Credits	4
Course Prerequisite	Basic Knowledge of Computers
Course Synopsis	The concepts of mathematics-II are introducing students to the basic concepts and logic of statistical reasoning and gives the students introductory-level practical ability to choose, generate, and properly interpret appropriate descriptive and inferential methods.

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

CO1	The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
CO2	The basic ideas of statistics including measures of central tendency, correlation and regression.
CO3	The statistical methods of studying data samples.

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**
CO1	**3**	**3**	**3**	**3**	**2**							**1**
CO2	**3**	**3**	**3**	**3**	**2**							**1**
CO3	**3**	**3**	**3**	**3**	**2**							**1**
Average	**3**	**3**	**3**	**3**	**2**							**1**

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
3	**1**	**0**	**4**

Unit	Content	Competencies
1	Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete; Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	C1 C2 C3
2	Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.	C1 C2 C3

3	Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	C1 C2 C3
4	Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	C1 C2 C3

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	24
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	13
Problem Based Learning (PBL)	11
Case/Project Based Learning (CBL)	--
Revision	4
Others If any:	--
Total Number of Contact Hours	52

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**			
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐			
Unit test	☐	☐	☐			

Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐			
Mid Semester Examination 2	☐	☐	☐			
University 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 (i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. (ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint). (iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002. (iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. (v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010. (vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Basics of Electrical and Electronics Engineering**
Academic Year	I
Semester	II
Number of Credits	3
Course Prerequisite	Basic Knowledge of Computers
Course Synopsis	This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Outcomes:

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

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
CO2	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical applications.

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**
CO1	**3**	**3**	**3**	**3**	**2**							
CO2	**3**	**3**	**3**	**3**	**2**							
CO3	**3**	**3**	**3**	**3**	**2**							
CO4	**3**	**3**	**3**	**3**	**2**							
CO5	**3**	**3**	**3**	**3**	**2**							
Average	**3**	**3**	**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	Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition Theorem, Thevenin's Theorem, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta	C1 C2 C3 C4

	Transformation. Application of theorem to the Analysis of D.C. circuits.	
2	A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth. Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component	C1 C2 C3
3	Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents. P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation. Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.	C1 C2 C3
4	Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents. Application of BJT: CB, CE configurations, Introduction to FETs and MOSFETs.	C1 C2 C3

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	24
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4
Problem Based Learning (PBL)	11
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	39

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2

Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA		▯		▯		
Assignment / Presentation	▯	▯	▯	▯	▯	
Unit test	▯	▯	▯	▯	▯	
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯	▯	
Mid Semester Examination 2	▯	▯	▯	▯	▯	
University 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. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi. 2. B L Thareja – A text book of Electrical Technology 3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10th Edition. 4. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27th Edition.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Basics of Electrical & Electronics Engineering Lab**
Academic Year	I
Semester	I
Number of Credits	1
Course Prerequisite	
Course Synopsis	This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

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

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
CO2	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical application.

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**
CO1	**3**	**3**	**3**	**3**	**2**							
CO2	**3**	**3**	**3**	**3**	**2**							
CO3	**3**	**3**	**3**	**3**	**2**							
CO4	**3**	**3**	**3**	**3**	**2**							
CO5	**3**	**3**	**3**	**3**	**2**							
Average	**3**	**3**	**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.	To get familiar with the working knowledge of the following instruments: ● Cathode ray oscilloscope (CRO) ● Multimeter (Analog and Digital) ● Function generator	C1, C2

	• Power supply	
2.	To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO	C2, C3, C4
3.	To Verify the Thevenin' s and Norton's theorem	C1, C2, C3, C4
4.	To Verify the Superposition theorem	C1, C2, C3, C4
5.	To measure voltage, current and power in an A.C. circuit by LCR impedance method	C3, C4
6.	To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO	C3, C4, C5
7.	To study the frequency response curve in series and parallel R-L-C circuit • Plot the forward and reverse V-I characteristics of P-N junction diode • Calculation of cut-in voltage • Study of Zener diode in breakdown region	C3, C4, C5
8.	To plot and study the input and output characteristics of BJT in common-emitter configuration.	C3, C4, C6
9.	Verification of truth tables of logic gates.	C3, C4, C5
10.	To get familiar with the working and use of seven-segment display.	C1, C2

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)	8
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	26

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation

Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA	☐	☐	☐	☐	☐	
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	
Demonstration	☐	☐	☐	☐	☐	
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐	☐	
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 (Civil Engineering)**
Course Code	
Course Title	**Engineering Graphics and Design**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	
Course Synopsis	This course let you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

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

CO1	To formulate simple algorithms for arithmetic and logical problems.
CO2	To translate the algorithms to programs (in C language).
CO3	To test and execute the programs and correct syntax and logical errors.
CO4	To implement conditional branching, iteration and recursion.
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO6	To use arrays, pointers and structures to formulate algorithms and programs.

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
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**		**3**	**3**				**3**	**2**		
CO3		**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**				
CO5	**3**	**3**	**3**	**3**		**3**		**2**				
CO6	**3**	**3**	**3**	**3**	**2**	**1**	**2**					
Average	**2.5**	**3**	**2.5**	**3**	**1.3**	**1.5**	**0.3**	**0.6**	**0.5**	**0.3**		

Course Content:

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

Unit	Content	Competencies
1	Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and	C1 C2 C3

	numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code,Arithmetic expressions and precedence.	
2	Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms.	C1 C2 C3
3	Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Finding roots of equations, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Quick sort.	C1 C2 C3 C4
4	Structures, Defining structures and Array of Structures Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)	C1 C2 C3

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	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	26

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2

Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						
VIVA	▯	▯				
Assignment / Presentation	▯	▯	▯	▯	▯	▯
Unit test	▯	▯	▯	▯	▯	▯
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯	▯	▯
Mid Semester Examination 2	▯	▯	▯	▯	▯	▯
University 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 (i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill (ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Engineering Graphics and Design Lab**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	
Course Synopsis	Engineering Graphics and design is considered as language of engineers. This course is introduced to provide basic understanding of importance of designing aspects in engineering applications. The topics are covered in a sequence and starts 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 drawing.
CO2	Acquire the visualization skills and use of projection methods.
CO3	Able to draw the 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**	**3**	**3**	**2**							**1**
CO2	**3**	**3**	**3**	**3**	**2**							**1**
CO3	**3**	**3**	**3**	**3**	**2**							**1**
CO4	**3**	**3**	**3**	**3**	**2**							**1**
Average	**3**	**3**	**3**	**3**	**2**							**1**

Course Content:

L (Hours/Week)	**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0	**0**	**4**	**2**

Experiment No.	**Content**	**Competencies**
1.	Different types of lines with illustration and application.	C2, C3, C6
2.	Use of Drawing instruments and understands the design sheet layout with dimensioning and lettering.	C2, C3, C6

3.	Applications of drawing commands in AutoCAD.	C2, C3, C6
4.	Projection of points in all the four quadrants.	C2, C3, C6
5.	Projection of straight lines parallel, perpendicular, inclined to projection planes and traces of lines.	C2, C3, C6
6.	Projection of plane in perpendicular and inclined positions.	C2, C3, C6
7.	Projection of cones and solid cylinders with axes parallel, perpendicular and inclined to both the reference planes.	C2, C3, C6
8.	Projection of prisms and pyramids with axes parallel, perpendicular, inclined to both the reference planes.	C2, C3, C6
9.	Design Orthographic projection of simple machine elements and engineering drawings.	C2, C3, C6
10.	Design Isometric projection of simple machine elements and engineering drawings.	C2, C3, C6
11.	Design Sectional views of simple machine elements and engineering drawings.	C2, C3, C6
12.	Different types of lines with illustration and application.	C2, C3, C6

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	13
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	26
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	13
Revision	--
Others If any:	--
Total Number of Contact Hours	52

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce

	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA	☐	☐	☐	☐	☐	
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book/Drawing	☐	☐	☐	☐	☐	
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐	☐	
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 III

SEMESTER - III

Course Code	Course Title
	Strength of materials
	Strength of materials Lab
	Surveying
	Surveying Lab
	Building Construction & Material
	MGE-3
	VASE-3
	AECC-3
	Summer Internship
Program Elective-I Pool (Choose One from the pool)	
	Civil Infrastructure and Society
	Structural Mechanics
	Introduction to Sustainable development
	Air, Noise Pollution and Control
Additional Subjects for Specialization Artificial Intelligence & Data Science	
	Introduction To Data Science
	Introduction To Data Science LAB

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Strength of materials**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	-
Course Synopsis	This course introduces the basic of strength of materials. 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 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
CO1	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**
CO2	**3**	**3**	**3**	**3**	**2**			**2**	**1**	**2**	**2**	
CO3	**3**	**3**	**3**	**2**	**2**			**2**	**1**	**2**	**2**	
CO4	**3**	**3**	**3**	**2**	**1**	**1**		**2**	**1**	**2**	**2**	
Average	**3**	**3**	**3**	**3**				**2**	**2**	**2**	**2**	

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), Describe One Dimensional loading of members of varying cross sections (C2), Discuss the Compound stresses: General state of stress, resultant stress and strain (C2), Describe principal stresses and principal strains (C2), Use of Mohr's circle for determination of stresses and strains (C3).

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

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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 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 (Civil Engineering)**
Course Code	
Course Title	**Strength of Materials Lab**
Academic Year	II
Semester	III
Number of Credits	1
Course Prerequisite	
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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**1**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**		**1**	**1**			**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)
2.	Demonstrate compression test on Bricks (C3)
3.	Investigation of elastic constant of steel beams experimentally (C6)
4.	Experimental verification of Maxwell theorem (C4)
5.	Demonstrate the compression and tension test on helical springs (C3)
6.	Demonstrate the torsion test on mild steel and HYSD bars. (C3)
7.	Investigate the critical buckling load and deformation of column for different end conditions (C6)

8.	Experiment on the deflection of steel truss (C4)
9.	Investigate the different end condition of column (C6)

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA	▯	▯	▯	▯		
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	▯	▯	▯	▯		
Demonstration	▯	▯	▯	▯		
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	▯	▯	▯	▯		
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 (Civil Engineering)**
Course Code	
Course Title	**Surveying**
Academic Year	II
Semester	III
Number of Credits	2
Course Prerequisite	
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**
CO1	**3**	**3**	**3**	**3**	**2**						**2**	**1**
CO2	**3**	**3**	**3**	**3**	**2**						**2**	**1**
CO3	**3**	**3**	**3**	**3**	**2**							**1**
CO4	**3**	**3**	**3**	**3**	**2**							**1**
Average	**3**	**3**	**3**	**3**	**2**						**1.2**	**1**

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), Describe the conventional tape measurements and electronic distance measurement (C2), 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).
2	Use of Dumpy level, Tilting level and Auto level (C3). Describe the Temporary and Permanent adjustment of Dumpy level (C2). Compare the differential

	leveling, Longitudinal & Cross sectional leveling, refraction & curvature correction, Reciprocal leveling (C4) Describe the contouring and characteristics of contours, contour gradient, (C2), plotting and use of contours (C3).
3	Describe and compare the theodolites– Temporary and Permanent adjustments (C2 and C4), Formulate the horizontal and vertical angle measurements (C6), measurement of magnetic bearing. Describe the electronic total station-Introduction and determination (C2 and C6). Classify the different system of tachometric measurement (C2), Use of Principle of stadia method (C3), Formulate the distance and elevation for staff in different position (Normal, Vertical, Inclined) (C6)
4	Compare the different methods of plane table surveying (C2), Investigate the two- and three-point problems as well as mechanical and graphical method for orientation of plane table (C6). Investigate the adjustment of closed traverse (C6). Describe the principles of geodetic surveying and corrections (C2), Use of GPS & GIS in surveying (C3)

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

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

VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	**Surveying Lab**
Academic Year	II
Semester	III
Number of Credits	2
Course Prerequisite	
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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**	**3**	**3**	**2**						**2**	**1**
CO2	**3**	**3**	**3**	**3**	**2**						**2**	**1**
CO3	**3**	**3**	**3**	**3**	**2**							**1**
CO4	**3**	**3**	**3**	**3**	**2**							**1**
CO5	**3**	**3**	**3**	**3**	**2**						**2**	**1**
Average	**3**	**3**	**3**	**3**	**2**						**1.2**	**1**

Course Content:

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

Experiment No.	**Content**
1.	Demonstrate the measurement of distance using tape (C3)
2.	Demonstrate the measurement of distance using chain (C3)
3.	Demonstrate the Chain Survey by perpendicular offsets (C3)
4.	Application of Compass Survey-Traversing using surveyor (C3)
5.	Application of Compass Survey-Traversing using prismatic compass (C3)

6.	Investigate the horizontal angles by method of repetition and reiteration using Theodolite (C6)
7.	Demonstrate the Two-point problem using Plane Table Survey-(Lehman's method) (C3)
8.	Demonstrate the Three-point problem using Plane Table Survey-(Lehman's method) (C3)
9.	Levelling- Rise & Fall method (C4)
10.	Levelling- Height of collimation method (C4)
11.	Tacheometric survey- Determination of additive and multiplication constant (C5)
12.	Tacheometric survey- Determination of horizontal distance (C5)
13.	Tacheometric survey- Determination of RL (C5)
14.	Determine the contours for a given location (C4)
15.	Determine the angle and distance using theodolite (C3)
16.	Determine the angle and distance using theodolite (C3)
17.	Determine the angle and distance using total station (C3)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	32
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	8
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA	☐	☐	☐	☐	☐	
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	
Demonstration	☐	☐	☐	☐	☐	
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐	☐	
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 (Civil Engineering)**
Course Code	
Course Title	**Building construction and materials**
Academic Year	II
Semester	III
Number of Credits	2
Course Prerequisite	
Course Synopsis	Building construction and 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	**3**	**3**		**3**				**3**				
CO2	**3**	**3**		**3**	**3**				**3**	**2**	**3**	
CO3		**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**		**3**		**3**		**2**			**3**	
CO5	**3**	**3**		**3**		**3**		**2**			**1**	
CO6	**3**	**3**		**3**	**2**	**1**	**2**					
Average	**2.5**	**3**	**0.5**	**3**	**1.3**	**1.5**	**0.3**	**1.1**	**0.5**	**0.3**	**1.1**	

Course Content:

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

Unit	Content
1	Classify the different types of building materials (C2), Discuss the Physical and Mechanical properties of construction materials such as

	stones, brick, cement, aggregate, timber, tiles (C2). Test of said materials as per BIS specifications (C4), 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), 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) Evaluate the advantages and disadvantages of various types of bonds in brick masonry, considering factors such as structural integrity, aesthetics, and cost-effectiveness (C4)
3	Understand the basic facts and concepts related to thermal insulation and acoustics in building construction (C1). Explaining the types of materials used for thermal insulation, such as fiberglass, foam boards, reflective insulation, and cellulose (C2). 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) assess the performance of different thermal insulation materials and methods (C6) 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). Analyze the causes and consequences of faulty construction and damage to buildings (C4) Evaluate existing preventive measures, damage assessment techniques, and repair and rehabilitation methods (C6) 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	24
Practical	--
Seminar/Journal Club	4
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
Seminars	University Examination
	Short Answer Questions (SAQ)
	Long Answer Question (LAQ)

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	☐
Unit test	☐	☐	☐	☐	☐	☐
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	☐
Mid Semester Examination 2	☐	☐	☐	☐	☐	☐
University 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. 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.

Program Elective - I

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Civil Infrastructure and Society**
Academic Year	III
Semester	VIII
Number of Credits	3
Course Prerequisite	NA
Course Synopsis	This course explores the relationship between civil infrastructure and society, focusing on the impact of infrastructure systems on communities and the environment. It examines the planning, design, construction, operation, and maintenance of various infrastructure components, including transportation, water supply, wastewater management, energy systems, and communication networks. Students will gain an understanding of the social, economic, and environmental implications of infrastructure development and learn how to approach infrastructure projects in a sustainable and socially responsible manner.

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

CO1	Understand the fundamental concepts and principles of civil infrastructure and its role in society.
CO2	Analyze the social, economic, and environmental impacts of infrastructure projects.
CO3	Examine the challenges and opportunities associated with sustainable infrastructure development.
CO4	Gain knowledge of relevant regulations, policies, and ethical considerations in civil infrastructure 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**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**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 basic facts and concepts related to civil infrastructure. This includes having a definition of civil infrastructure and understanding its scope within the field of civil engineering (C2), Evaluate existing infrastructure practices and policies (C5). Assess the effectiveness of current approaches to infrastructure development and identify areas for improvement (C5), Assess the impact of existing infrastructure on economic growth, social equity, and sustainable urbanization (C5)
2	Understanding of infrastructure planning and design (C2), Understanding the principles and decision-making processes involved in developing infrastructure projects (C2), Application of environmental impact assessment and sustainability considerations during the infrastructure planning and design (C3), Investigate the Environmental impact assessment methods to evaluate the potential effects of infrastructure projects on ecosystems, natural resources, and communities (C6), Evaluate the long-term sustainability and performance of infrastructure systems (C5).
3	Discuss the Road networks, public transit systems, transportation infrastructure and intelligent transportation systems (C2), designing and optimizing road networks, such as traffic flow, capacity, and safety (C6), analyze the complexities and challenges associated with transportation infrastructure (C4), evaluate existing transportation infrastructure practices and policies(C5). Knowledge of different water sources, such as surface water and groundwater, and the infrastructure required for water supply, including reservoirs, pumping stations, and distribution networks (C2), analyze the complexities and challenges associated with water supply systems and management (C4), evaluate the performance of water supply infrastructure by analyzing factors such as water quality, reliability, and resilience to climate change (C5). Assess the performance of water supply infrastructure evaluate existing water supply systems, wastewater management practices, stormwater management strategies, and water conservation efforts (C5).
4	Understanding of equity and accessibility in infrastructure development (C2), apply climate change adaptation and mitigation strategies by integrating resilience measures into infrastructure design (C3), analyze the complexities and trade-offs associated with equity and accessibility in infrastructure development (C4) analyze the vulnerabilities of infrastructure systems to climate change impacts (C4), assess the effectiveness of adaptation and mitigation measures (C5), and identify potential synergies between climate action and sustainable infrastructure development (C2), understanding of equity and accessibility in infrastructure development (C2), Applying knowledge of equity and accessibility in infrastructure development (C3), analyze the performance of sustainable infrastructure policies and practices by considering environmental, social, and economic indicators

	(C4), analyze the performance of sustainable infrastructure policies and practices by considering environmental, social, and economic indicators (C4)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	39
Practical	--
Seminar/Journal Club	3
Small group discussion (SGD)	3
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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Quiz	Mid Semester Examination 2
Seminars	University Examination
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		
Mid Semester Examination 2	▯	▯	▯	▯		
University 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:	(List of books)					

	Text Books 1. Mohammed M. Ettouney**,** Sreenivas Alampalli, Infrastructure Health in Civil Engineering: Theory and Components. Ist Edition, CRC Press. **Reference Books** 1. Neil S. Grigg, Water, Wastewater, and Stormwater Infrastructure Management 2nd Edition, CRC Press. 2. J.S. Jensen, Operation and Maintenance of Large Infrastructure Projects, 1st edition Routledge.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Structural Mechanics**
Academic Year	2
Semester	III
Number of Credits	3
Course Prerequisite	
Course Synopsis	Structural Mechanics is a comprehensive course that introduces the fundamental principles and concepts of structural analysis and design. It covers the behavior and analysis of various structural components and systems, including beams, columns, trusses, and frames. Students will learn to apply mathematical and physical principles to analyze the response of structures to external loads and understand the factors influencing structural stability and strength. The course also introduces structural design methodologies and codes, emphasizing the importance of safety, efficiency, and sustainability in structural engineering.

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

CO1	Understand the basic principles and concepts of structural mechanics.
CO2	Analyse and calculate internal forces, stresses, deformation and displacement in determinate structures
CO3	Apply appropriate analysis techniques to determine reactions, shears, and bending moments in determinate structures.
CO4	Design simple structural elements based on strength, stiffness, and stability requirements.

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**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**	**2**		**1**			**1**	**1**

Course Content:

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

3	0	0	3

Unit	Content
1	Understanding the basic concept of Force Systems (C2), knowledge of the equilibrium conditions for rigid bodies and the concepts of translational and rotational equilibrium (C2), analyzing and solving problems related to particle equilibrium in 2-D and 3-D (C5), concept of torque and its application in determining the resultant moment of forces (C2), analyze the complexities and relationships within force systems (C4), synthesize principles of static indeterminacy, kinematics, and equations of motion to analyze dynamic systems and predict the motion of objects under the influence of forces (C4 & C5), Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy Kinematics, Statics, Equations of Motion.
2	Understanding the basic concepts and types of friction, including static friction and dynamic friction (C2), knowledge of friction involves analyzing and solving problems related to its effects on motion and equilibrium (C1), **State the law of friction (C1),** Differentiate between Static and Dynamic Friction (C4); evaluate the motion of Bodies (C5), analysis of screw jack & differential screw jack (C4)
3	Basic Structural Analysis: Demonstrate the concept of Equilibrium in three dimensions (C3); Differentiate and analysis of truss using method of Sections and method of Joints (C4); Evaluation of member in tension or compression (C5); understanding the concept of Zero force members (C2); Classify the beam and frames (C2), analyze the Beams (C4)
4	Centroid and Centre of Gravity: Compare the centroid of simple figures from first principle and composite sections (C4); Evaluation of Centre of Gravity of different sections (C5), understanding the concept of moment of inertia and Theorems of moment of inertia (C2) and evaluation of Moment of inertia of plane sections from first principles and composite sections (C5), analyze and compare the mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook (C4 and C5)

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)	3
Case/Project Based Learning (CBL)	--

Revision	4
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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:	(List of books)
	Text Books 1. 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.

Faculty of Engineering & Technology												
Name of the Department	**Civil Engineering**											
Name of the Program	**Bachelor of Technology (Civil Engineering)**											
Course Code												
Course Title	**Introduction to Sustainable development**											
Academic Year	II											
Semester	III											
Number of Credits	3											
Course Prerequisite												
Course Synopsis	The course "Introduction to Sustainable Development" provides a comprehensive overview of the principles, theories, and practices related to sustainable development. It explores the multidisciplinary nature of sustainability and its relevance to environmental, social, and economic dimensions. Students will examine the challenges and opportunities associated with achieving sustainable development at global, regional, and local levels. The course aims to foster critical thinking and problem-solving skills, enabling students to understand and contribute to sustainable development initiatives in various fields.											
Course Outcomes: At the end of the course students will be able to:												
CO1	Identify and describe the three pillars of sustainability: social, economic, and environmental.											
CO2	Understand the interconnectedness of social, economic, and environmental systems in sustainable development.											
CO3	Evaluate the principles and practices of sustainable resource management.											
CO4	Recognize the role of various stakeholders, including governments, businesses, and civil society, in advancing sustainable 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**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**

CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**1**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**						**1**	**1**

Course Content:

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

Unit	Content
1	Define the principles of sustainable development and explain its significance in addressing global challenges (C1, C2), Analyze the environmental dimensions of sustainability (C4), focusing on ecological systems and the management of natural resources, Evaluate climate change and its impacts on the environment (C5), Assess the effectiveness of climate change mitigation strategies and their potential for reducing greenhouse gas emissions (C5), Analyze the challenges and opportunities in implementing sustainable water and waste management practices (C4), Critically evaluate the current state of sustainability efforts and their impact on addressing global challenges (C5), Analyze the effectiveness of policies, initiatives, and technologies in achieving sustainable development goals (C4), Propose innovative solutions and strategies for promoting environmental sustainability, considering the complex interactions between ecological systems, natural resources, and human activities (C6)
2	Define and explain the concepts of social equity, justice, and human rights in the context of sustainable development (C1, C2), Analyze poverty alleviation strategies and their role in promoting inclusive development (C4), Evaluate community engagement and participatory approaches in sustainable development initiatives (C5), Assess the impact of sustainable development on health and well-being (C5). evaluate the social equity, justice, and human rights aspects of sustainable development (C5) Define and explain the concepts of sustainable consumption and production patterns (C1, C2), Analyze the principles and practices of the circular economy and their role in waste reduction (C4), Evaluate the benefits and challenges of transitioning towards a circular economy (C5), Evaluate different economic models for sustainable development, such as the green economy, inclusive growth, and decoupling (C5), Evaluate the adoption and implementation of circular economy principles in waste reduction and resource efficiency. Analyze the impact of sustainable finance and green business practices on environmental and social sustainability (C5)
3	**Concept of** Renewable energy sources and technologies (C2), evaluation of Energy efficiency and conservation (C5), analysis of Sustainable

	transportation systems and mobility (C4), application of innovation and technology in energy and transportation sectors (C3)
4	**Concept of Sustainable Urban Planning and Design (C2), explain** Smart cities and urban resilience (C2), analysis of Sustainable transportation and infrastructure in cities (C4), Application of Social and economic aspects of urban sustainability (C3), Analysis of successful and challenging sustainability projects (C4)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	36
Practical	--
Seminar/Journal Club	06
Small group discussion (SGD)	03
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		

Mid Semester Examination 2	☐	☐	☐	☐		
University 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. Peter P. Rogers**,** Kazi F. Jalal, An Introduction to Sustainable Development, 1st edition, Routledge. **Reference Books** 1. Joy Sen, Sustainable Urban Planning. The Energy and Resources Institute, TERI; 2013th edition					

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Air, Noise Pollution and Control**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	Environmental science
Course Synopsis	Increased air and noise pollution is the common impact of industrialization lead to the several dangerous and untreatable impacts on human beings. Students learn about air pollutants, particulates and gaseous pollutants, effects of air pollution on human beings, elements of atmosphere and dispersion of pollutants, meteorological factors, principles and design of air pollution control measures, air quality monitoring, air pollution control measures, sources of noise pollution, environmental and industrial noise and effects of noise pollution.

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

CO1	Identify and describe the sources and types of air pollutants
CO2	Evaluate the techniques and technologies used for air and noise pollution monitoring and assessment.
CO3	Understand the health and environmental impacts of air and noise pollution
CO4	Assess the effectiveness of control measures and mitigation strategies for air and noise pollution.

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
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**2**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**
Average	**3**	**3**	**3**	**3**	**2**		**1**		**1**			**1**

Course Content:

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

Unit	Content

1	Classification and differentiate the different air pollutants i.e. Particulates and gaseous pollutants (C2, C4), Investigate the Sources of air pollution and its effect on human beings, materials, vegetation, animals (C6), Discuss the Source inventory (C2), Analysis of global warming and ozone layer depletion (C4), Understanding the Basic Principles and sources of Sampling (C2), Analysis of pollutants (C4)
2	Explain the elements of atmosphere and dispersion of pollutants, including meteorological factors, wind roses, lapse rate, atmospheric stability and turbulence, plume rise, and dispersion of pollutants (C2); Describe the concepts and principles of Gaussian dispersion models and their applications in studying the dispersion of pollutants (C2 and C4), Discuss the concepts of control measures and their design, focusing on particulate control methods such as gravitational settling, centrifugal separation, filtration, scrubbing, and electrostatic precipitation (C2, C4, C6), Analyze pollution control strategies specific to major industries (C4), Analyze the principles and techniques involved in controlling gaseous emissions using adsorption, absorption, condensation, and combustion (C4), Compare and contrast various control methods and propose recommendations for optimizing pollution control strategies (C4 and C5)
3	Describe air quality standards and their importance in regulating and maintaining acceptable levels of air pollution (C2), concept of air quality monitoring and its role in assessing and managing air pollution (C2, C4) Analyze air pollution control efforts and their effectiveness in reducing pollutants (C4), Evaluate the legislation and enforcement mechanisms related to air pollution control (C5), Compare and contrast different methods used in air quality monitoring including sampling techniques, data analysis, and the use of monitoring equipment and technologies (C4), Evaluate the role of zoning and town planning regulations in preventing the establishment of polluting industries in sensitive areas (C5), Assess the effectiveness of various air pollution control measures and strategies (C5), Critically evaluate the methodologies used in Environmental Impact Assessments (C5)
4	Identify and describe the sources of noise pollution including both environmental and industrial sources (C2), Explain the effects of noise pollution on human health and the environment (C2), Understand the fundamentals of sound generation and propagation (C2), Differentiate between various types of sound level meters and their components (C4), Evaluate noise prevention and control measures in both environmental and industrial setting (C5), Analyze the effectiveness of different strategies and techniques employed to mitigate noise pollution (C4), Assess the impact of noise pollution on different stakeholders, including individuals, communities, and ecosystems (C5), Critically evaluate the existing noise control measures and legislation (C5)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	33
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	05
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	07
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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:	(List of books)
	Text Books 1 M N Rao& H V N Rao (2007), Air Pollution, Tata McGraw-Hill Publishing Company, 26th reprint, New Delhi. 2. Noel De Nevers (2010), Air Pollution Control Engineering, 2nd Edition, Waveland Press, Inc., Long Grove, Illinois. **Reference Books** 1. Singal, S.P. (2000), Noise Pollution and Control, First Edition, Narosa Publishing House, New Delhi. 2. Rao C.S. (2006) Environmental Pollution Control Engineering, 2nd edition, New Age International,New Delhi. 3. William L.Heumann (1997), Industrial Air Pollution Control Systems, McGraw Hill Professional, New York.

SEMESTER - IV

Course Code	Course Title
	Structural Analysis
	Fluid Mechanics
	Fluid Mechanics Lab
	Concrete technology
	Concrete technology Lab
	Civil Engineering Drawing Lab
	VASE-4
	AECC-4
Program Elective-II Pool (Choose One from the pool)	
	Advanced Surveying
	Environment impact assessment
	Engineered Systems and Sustainability
	Introduction to AI and Data Analytics for Civil Engineering
Additional Subjects for Specialization Artificial Intelligence & Data Science	
	Data analysis using Python
	Data analysis using Python Lab

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Structural Analysis**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	
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
CO1	**3**	**3**	**2**	**2**	**1**	**1**		**3**	**2**	**1**	**3**	**2**
CO2	**3**	**3**	**2**	**2**	**1**	**1**		**3**	**2**	**1**	**3**	**2**
CO3	**3**	**3**	**2**	**2**	**1**	**1**		**3**	**2**	**1**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**1**	**1**		**3**	**2**	**1**	**3**	**2**
Average	**3**	**3**	**2**	**2**	**1**	**1**		**3**	**2**	**1**	**3**	**2**

Course Content:

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

Unit	Content
1	Define static determinacy and indeterminacy (C1), Explain the Theorem of Three Moments (C2), Analyze beams and frames using the slope deflection method and moment distribution method (C4 and C6)

2	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); analysis and design of arches, cables, and influence lines (C4, C6) analyze the horizontal thrust and bending moments in arches by using influence lines diagram (C4); understanding of Castigliano's theorem and its applications for the calculation of deflections in statically determinate beams and trusses (C2, C3, C4)
3	basic understanding of the strain energy method and its application in analyzing indeterminate structures (C1, C3, C4), Classify beam and joints (C2); difference between pin jointed and rigid jointed structures (C4), analysis of beam against temperature effect (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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**

Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	☐
Unit test	☐	☐	☐	☐	☐	☐
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	☐
Mid Semester Examination 2	☐	☐	☐	☐	☐	☐
University 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. 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. 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 (Civil Engineering)**
Course Code	
Course Title	**Fluid Mechanics**
Academic Year	II
Semester	IV
Number of Credits	3
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	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**
CO1	**3**	**3**		**3**	**3**				**2**		**2**	
CO2	**3**	**3**		**3**	**3**				**2**		**2**	
CO3	**3**	**3**		**3**	**3**				**2**		**2**	
CO4	**3**	**3**		**3**	**3**				**2**		**2**	
Average	**3**	**3**		**3**	**3**				**2**		**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 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); understanding of fluid pressure at a point and Pascal's law and their practical applications (C3, C4); pressure measurements using manometers and piezometers (C5); determine the hydrostatic forces on plane, inclined and curved surfaces submerged in a fluid (C5); analysis of stability and equilibrium for

	floating and submerged bodies (C4), measurement of Pressure at a point in incompressible fluid (C5)
2	Basic understanding of fluid flow and fluid kinematics (C1), classify the different types of flow including steady, unsteady, uniform, non-uniform, rotational, irrotational, and 1-D, 2-D, and 3-D flows (C2); Derive Euler and Bernoulli's equations and their applications, (C3); 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); 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); differentiation between laminar and turbulent flow (C4); design and operation of hydraulic machines, including centrifugal and reciprocating pumps, and turbines (C6); Derivation/Formulation of Raleigh and Buckingham π theorems, Model laws; distorted and undistorted models (C6); Compare the types of similarities (C4); differentiate the various types of forces acting on moving fluid and dimension less numbers (C4)

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	□	□	□	□		
Unit test	□	□	□	□		
Practical Log Book/ Record Book						
Mid Semester Examination 1	□	□	□	□		
Mid Semester Examination 2	□	□	□	□		
University 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. 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 (Civil Engineering)**
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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**		**3**	**3**				**2**		**2**	**3**
CO2	**3**	**3**		**3**	**3**				**2**		**2**	**3**
CO3	**3**	**3**		**3**	**3**				**2**		**2**	**3**
CO4	**3**	**3**		**3**	**3**				**2**		**2**	**3**
Average	**3**	**3**		**3**	**3**				**2**		**2**	**3**

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)
2.	Determination of the Coefficient of discharge of given Venturi-meter (C5)
3.	Determination of the Coefficient of discharge of given rectangular notch (C5)
4.	Determination of the Coefficient of discharge of given V- notch (C5)
5.	Determination of head loss in pipes connected in series (C5)
6.	Examine the performance characteristics of reciprocating pump (C4)

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

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA	▯	▯	▯	▯		
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	▯	▯	▯	▯		
Demonstration	▯	▯	▯	▯		
Mid Semester Examination 1						

Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐		
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 (Civil Engineering)**
Course Code	
Course Title	**Concrete technology**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	
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**
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**
CO6	**2**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**2**	**1**
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**
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); Application of raw materials in the production of concrete (C3); tests on cement, aggregates, water etc. (C4); Analysis of Bogue's compound and hydration of cement (C4)
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 ACI method and I.S. code method (C6); 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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)

	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	☐
Unit test	☐	☐	☐	☐	☐	☐
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	☐
Mid Semester Examination 2	☐	☐	☐	☐	☐	☐
University 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. Gambhir, M.L., Concrete Technology (2012) ISBN No. 978-00-07-015133, 9th Edition, Tata McGraw Hill. **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 (Civil Engineering)**
Course Code	
Course Title	**Concrete technology Lab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	
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**
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**
CO6	**2**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**2**	**1**
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**	**2**	**2**

Experiment No.	**Content**
1.	Compressive Strength test of Cement Cube (C4)

2.	Determine standard consistency test (C4, C5)
3.	Determine Initial and Final setting time of cement (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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						

VIVA	☐	☐	☐	☐	☐	☐
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐	☐	☐
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 (Civil Engineering)**
Course Code	
Course Title	**Civil Engineering Drawing Lab**
Academic Year	II
Semester	IV
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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
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)

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

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

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

VIVA	☐	☐	☐	☐	☐	
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	
Demonstration	☐	☐	☐	☐	☐	
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination (External Practical)	☐	☐	☐	☐	☐	
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						

Program Elective – II

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Advanced Surveying**
Academic Year	II
Semester	III
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**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**							**1**

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

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						

Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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:	(List of books)
	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

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Environment Impact Assessment**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	Basic Environment Science
Course Synopsis	Environmental Impact Assessments (EIA) provides a tool that assists in the anticipation and minimization of development's negative effects. Undertaken in the early stages of project planning and design, EIA helps shape development in a manner that best suits the local environment and is most responsive to human needs.

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

CO1	Students will be able to learn the concept and methodology of EIA.
CO2	Students will be able to implement the various EIA techniques
CO3	Students will be able to impacts knowledge of Socio-economic impact assessment

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
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**		**1**	**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 the Environmental Impact Assessment (EIA) including Types and limitations of EIA (C1, C2); Relate the application of EIA in the project cycle (C3, C4); weigh the legal and Regulatory aspects in India (C5), interpret the Cross sectoral issues and terms of reference in EIA along with the Public Participation in EIA (C3, C4)

2.	Basic concept of Matrices, Networks, Checklists, Connections and combinations of processes (C1, C2); Cost benefit analysis (C4), Selection of software packages for EIA and Expert systems in EIA (C5)
3	Basic concept of social impact assessment (C1, C2), Relation between social impacts and change in community and institutional arrangements (C4), Selecting, testing and understanding significant social impacts (C5), Development of Social impact assessment model and the planning process (C6), Investigate the communities in transition - neighborhood and community impacts (C6), Environmental costing of projects (C6)
4	Basic understanding of Environmental Management Plan (C1, C2), Describe the Mitigation and Rehabilitation Plans along with Policy and guidelines for planning and monitoring programmes (C2, C3), Assess the Ethical and Quality aspects of Environmental Impact Assessment (C4)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	33
Practical	--
Seminar/Journal Club	04
Small group discussion (SGD)	08
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	–
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						

Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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:	(List of books)
	Text Books 1.Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003. **Reference Books** 1. World Bank –Source book on EIA 2. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999. 3. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Engineered System and Sustainability**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	Introduction to structure
Course Synopsis	The course "Engineered Systems and Sustainability" explores the integration of sustainable practices and principles in the design, operation, and management of engineered systems. It provides students with an understanding of the environmental, social, and economic implications of engineered systems and the importance of sustainability in their development. The course covers various engineering disciplines, including civil, mechanical, electrical, and industrial engineering, and emphasizes the application of sustainable design principles and technologies to enhance system performance and minimize environmental impacts.

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

CO1	Understand the principles and frameworks of sustainable engineering design.
CO2	Identify and apply strategies for energy efficiency and renewable energy integration in engineered systems.
CO3	Analyze and evaluate the environmental impacts of engineered systems throughout their life cycle.
CO4	Evaluate the social and economic impacts of engineered systems and propose strategies for improvement.
CO5	Understand and apply relevant sustainability standards and guidelines in engineering practice.

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**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**
CO5	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**

Average	**3**	**3**	**3**	**3**	**2**	**2**			**2**		**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 engineered systems and sustainability (**Energy consumption and greenhouse gas emissions, Circular economy and closed-loop systems) **(C1, C2); relate the** principles and dimensions of sustainability (C4), Application of engineered systems in achieving sustainability goals (C3), Investigate the challenges and opportunities for sustainable engineering (C6); Life cycle assessment (LCA) and environmental footprint analysis (C4),
2	**Basic concept of sustainable materials and techniques (C2),** Selection and comparison of environmentally friendly materials, green building materials and construction practices, Energy-efficient technologies and systems, Sustainable transportation and mobility solutions (C2, C4, C5)
3	**Basic understanding of Energy Efficiency and Renewable Energy in Engineered Systems (C1, C2); comparison of** renewable energy sources, Smart grid technologies and energy management systems (C4), Development of Net-zero energy and energy-positive buildings (C6), application of Rainwater harvesting and graywater reuse, Wastewater treatment and resource recovery, Sustainable stormwater management practices (C3, C4)
4	**Basic understanding of social and economic Considerations in Engineered Systems (C1, C2); Value of** Ethical considerations in engineering decision-making (C5), Cost-benefit analysis and economic feasibility (C4); Compare the sustainable engineering technologies (C4), Integration of digitalization and artificial intelligence (C4, C5)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	36
Practical	--
Seminar/Journal Club	06
Small group discussion (SGD)	03
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		
Mid Semester Examination 2	▯	▯	▯	▯		
University 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:	(List of books)
	Text Books **Reference Books** 1. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Introduction to AI and Data Analytics for Civil Engineering**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	Programming for Problem solving
Course Synopsis	The course "Introduction to AI and Data Analytics for Civil Engineering" provides students with an understanding of the principles, methodologies, and applications of artificial intelligence (AI) and data analytics in the field of civil engineering. It covers fundamental concepts of AI, machine learning, and data analysis, and explores their relevance and potential in solving engineering problems. Students will learn how to collect, process, analyze, and interpret engineering data using AI and data analytics techniques, and apply them to various civil engineering domains such as structural analysis, transportation planning, and infrastructure management.

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

CO1	Understand the fundamental concepts and principles of Artificial Intelligence and Data Analytics in the context of civil engineering.
CO2	Apply machine learning algorithms to solve civil engineering problems.
CO3	Evaluate the performance and accuracy of AI and data analytics models.
CO4	Understand the ethical considerations and challenges associated with AI and data analytics in civil engineering.

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**
CO1	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**	**1**						**1**

Course Content:

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

3	0	0	3

Unit	Content
1	**Basic concept of artificial intelligence and** data analytics **(C1, C2), application of artificial intelligence and** data analytics in civil engineering (C3); investigate the role of AI and data analytics in decision-making processes along with Ethical considerations (C6); distinguish the data types and sources in civil engineering (C4); Compare the Data collection techniques and sensors (C4)
2	**Understanding of fundamental of machine learning (C1, C2), compare the s**upervised and unsupervised learning techniques and their application in civil engineering (C3, C4), Model selection and evaluation (C5), Applications of deep learning in civil engineering (C3), Distinguish artificial neural networks (ANN) with Convolutional neural networks (CNN) (C4); compare feedforward and backpropagation algorithms (C4)
3	**Application of** Linear regression and its applications in civil engineering (C3), Compare the linear and non-linear regression model (C4), Performance evaluation of prediction models (C5), distinguish binary and multiclass classification techniques (C4), application of support vector machines (SVM) in civil engineering (C3)
4	**Application of AI and Data Analytics in Civil Engineering Applications such as** Structural health monitoring and condition assessment, Traffic flow analysis and transportation planning, Smart cities and infrastructure management, Geotechnical and environmental data analysis (C3), Develop model for the solution of above problems (C6)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination

Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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:	(List of books)					
	Text Books **Reference Books**					

SEMESTER - V

Course Code	Course Title
	Reinforced Concrete Structures-I
	Hydrology
	Soil Mechanics
	Soil Mechanics Lab
	Engineering Geology
	BIM Lab
	Industrial Training - I / MOOC Course
	Personality Development & Career Building
Program Elective-III Pool (Choose One from the pool)	
	Advanced Structural Analysis
	Open channel flow
	Disaster Control and Management
	Earth and Environment
Additional Subjects for Specialization Artificial Intelligence & Data Science	
	Introduction to AI and ML
	Introduction to AI and ML Lab

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Reinforced Concrete Structures-I**
Academic Year	III
Semester	V
Number of Credits	4
Course Prerequisite	
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**
CO1	**3**	**3**	**3**	**3**	**2**			**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**2**			**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**2**			**3**	**3**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**2**				**3**	**1**	**1**		**1**
Average	**3**	**2.7**	**2.7**	**2.7**	**1.5**			**3**	**2.5**	**2.5**	**2**	**2.5**

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), 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), 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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		

Mid Semester Examination 2	☐	☐	☐	☐		
University 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 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 (Civil Engineering)**
Course Code	
Course Title	**Hydrology**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	
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
CO1	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO2	**3**	**2**	**2**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**2**
CO3	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**1**	**2**	**3**
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**

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); explain drainage basins and its characteristics, stream geometry, hypsometric curves (C2), compare different Types & forms of precipitation (C4); rainfall measurements, interpretation of rainfall data (C3); differentiate infiltration indices, Hydrograph analysis, Module hydrograph and Time Series Analysis (C4), application of application of hydrograph (C3); demonstrate runoff and runoff cycle (C3)	

2	Basic concept of evaporation Process, transpiration Process and infiltration Process (C2), measurement of Evapo-transpiration and potential evapo-transpiration (C5); derive Penman`s equation (C3); measurement of infiltration, infiltration indices (C5), demonstration of Infiltration process, initial loss, infiltration capacity (C3); compare the different methods of control of reservoir evaporation (C4), evaporimeters and empirical relationships in evaporation Process (C4)
3	Basic concept of Ground water-Aquifers, Permeability & transmissibility (C2); Interference among wells-well losses (C3), compare well and flow irrigation (C4); measurement of yield of an open well - Tube well & infiltration galleries (C5), Application of Dupits & Theims equation (C3)
4	Concept of flood routing (C2); application of flood routing for the construction of hydraulic reservoirs (C3); compare the Hydrologic routing and hydraulic routing (C4); appraise the methods of flood routing- Step by step method, trial and error method (C5)

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**			
Quiz						
VIVA						

Assignment / Presentation	☐	☐	☐			
Unit test	☐	☐	☐			
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐			
Mid Semester Examination 2	☐	☐	☐			
University 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.** Engineering Hydrology**,** K Subramanian (2014), 4th Edition, ISBN No. 978-1-25902997-4, Tata McGraw Hill.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Soil Mechanics**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	
Course Synopsis	Soil Mechanics 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**
CO1	**2**	**3**	**3**	**2**	**1**	**2**		**1**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**1**	**1**	**2**	**3**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**2**	**1**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**3**
Average	**2.8**	**2.8**	**2.5**	**1.5**	**1.5**	**2**	**1.8**	**2**	**2.3**	**2.8**	**3**	**3**

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); Demonstrate and Distinguish three phase and two phase system diagram (C3, C4);

	Compare different classification systems (C4), Weight-volume relations (C4); Investigate and examine the index properties (Atterberg's limits) and Theory of compaction (C4, C6)
2	Concept of capillary, permeability and seepage (C2); describe the Capillarity in soils and types of soil water (C2); Determination of permeability of soils and stratified soils (C5); Application of Darcy's law (C3); differentiate Seepage velocity and Seepage pressure (C4); describe Effective stress principle and Quick sand condition (C2)
3	Concept of Stress distribution in Soils, compaction (C2); 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); Compare Standard Proctor compaction test and Modified compaction test (C4); weigh the factor affecting compaction and soil properties (C5); discuss the Relative compaction, Field compaction and its control (C2)
4	Concept of compressibility and consolidation (C2); compare the Primary consolidation with secondary consolidation, normally consolidated soil, over consolidated soil and under consolidated soil (C4); classify the settlement and determination (C2; C5); Estimation of settlements - Terzaghi 1-D consolidation theory (C5); test for shear strength (C4)

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		
Mid Semester Examination 2	▯	▯	▯	▯		
University 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. 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, SponPress.
4. Soil Mechanics and Foundation Engineering by B.N.D. Narsinga Rao, 2015, Wiley India Pvt. Ltd. New Delhi.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Soil Mechanics Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	
Course Synopsis	The Soil Mechanics 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**
CO1	**3**	**3**	**2**	**2**		**2**		**2**	**2**	**1**		**1**
CO2	**3**	**2**		**2**		**1**	**2**	**1**	**1**	**1**	**1**	**1**
CO3	**3**	**2**	**2**	**2**		**1**	**2**	**2**	**2**	**2**	**2**	**2**
CO4	**3**	**2**		**2**		**1**	**2**	**1**	**2**	**1**	**1**	**1**
CO5	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**3**	**2**	**1**	**2**	**3**
CO6	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**1**
Average	**3**	**2.3**	**1.8**	**2**	**0.8**	**1.3**	**2**	**1.8**	**1.8**	**1.3**	**1.8**	**1.8**

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)
2.	Test for determination of specific gravity by pycnometer method (C4)
3.	Test for determination of Liquid & Plastic Limit of soil (C4)
4.	Tests for Grain size analysis of soil sample (C4)
5.	Test for determination of In Situ Density – Core cutter & Sand Replacement (C4)
6.	Demonstration of Standard Proctor Compaction Test and Modified Proctor Compaction Test (C3)
7.	Demonstration of Permeability Test (C3)
8.	Shear strength test (C4)

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						
VIVA	☐	☐	☐	☐	☐	☐

Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination (External Practical)	☐	☐	☐	☐	☐	☐
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 (Civil Engineering)**
Course Code	
Course Title	**BIM Lab**
Academic Year	III
Semester	V
Number of Credits	2
Course Prerequisite	
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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**	**2**	**1**		**2**		**2**	**2**	**1**		**1**
CO2	**3**	**2**		**1**		**1**	**1**	**1**	**1**	**1**	**1**	**1**
CO3	**3**	**2**	**2**	**1**		**1**	**1**	**2**	**2**	**2**	**2**	**2**
Average	**3**	**2.3**	**1.8**	**1**	**0.8**	**1.3**	**1**	**1.8**	**1.8**	**1.3**	**1.8**	**1.8**

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)
2.	Create Model of structure (C3)
3.	Level for the building (C3)
4.	Analysis of structure using Revit (C4)
5.	MEP in structure (C3)
6.	Analysis of MEP of building (C4)
7.	Create model and analysis of any building (C3, C4)
8.	Case study (C3)

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						
VIVA	☐	☐	☐	☐	☐	☐
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐
Mid Semester Examination 1						
Mid Semester Examination 2						

University Examination (External Practical)	☐	☐	☐	☐	☐	☐
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 (Civil Engineering)**
Course Code	
Course Title	**Engineering Geology**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**2**	**3**		**2**	**2**	**3**	**3**	**2**	**3**
Average	**3**	**3**	**3**	**2.8**	**2.8**	**0.5**	**1.3**	**2.8**	**2.5**	**2.8**	**2.3**	**2.8**

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); relationship between crystals and minerals (C4); 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); Analyze the formation processes of rocks and the factors influencing their classification (C4); 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)
2	Concept of geological map (C2); types and classifications of folds, faults, joints, and unconformities (C2); application of geological maps in understanding the Earth's surface (C3); Analyze the characteristics of outcrops to infer the geological history of an area (C4); Evaluate the impact of different types of folds, faults, joints, and unconformities on the geological evolution of an area (C5)
3	Analyze the factors and processes contributing to rock decay and weathering (C4); Analyze the stability of rock based on geological and geotechnical factors (C4); Evaluate the impact of rock decay and weathering on engineering structures and landscapes (C5)
4	Analyze the causes and effects of earthquakes and landslides along with the remedial measures (C4); Evaluate the impact of earthquakes and landslides on the safety and stability of engineering structures (C5); Evaluate the significance and implications of recent developments in engineering geology (C5); Analyze the challenges and opportunities in the field of engineering geology (C4).

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		
Mid Semester Examination 2	▯	▯	▯	▯		
University 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 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

Program Elective – III

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Advanced Structural Analysis**
Academic Year	3
Semester	V
Number of Credits	3
Course Prerequisite	Strength of materials
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**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**							**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); Analysis of beams, frames and trusses with internal and external redundancy (C4, C5, C6)
2	Understanding of cables (C2); Analysis and determination of forces in cables under concentrated and uniformly distributed loads (C4, C5, C6) Basic concept of finite element method (C1); differentiate elements, element shapes, nodes, shape function (C4)
3	Concept of flexibility matrix (C2), analysis of beam and frame using flexibility matrix method (C4, C5)
4	Basic concept of stiffness matrix (C1); 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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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:	(List of books)
	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.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Open Channel Flow**
Academic Year	3
Semester	V
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**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**							**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); Apply the continuity equation to solve problems related to fluid flow and mass conservation (C3); difference between pipe flow and free surface flow and their respective characteristics (C4); Analyze the continuity equation, Basic Momentum Equation, energy principle and its applications in fluid dynamics (C4); Evaluate the accuracy and precision of velocity measurement methods for flow analysis (C5); Application of the velocity-area method to estimate river discharges and radio-active tracer technique to measure flow rates in rivers (C3)
2	Understand the characteristics and importance of critical flow in open channels (C2), Understand the principles and operation of flow measurement devices such as flumes and weirs (C2); Comprehend the concept of brink depth and its relationship to flow measurements (C2); Apply the principles of flow measurement to select and use appropriate devices for accurate flow measurement (C3); Apply the concept of brink depth to determine the correct positioning of flow measurement devices (C3); Analyze the characteristics and behavior of critical flow in open channels (C4); Analyze the advantages and limitations of different flow measurement devices and techniques (C4); Analyze the design and performance of weirs and control structures in flow measurement applications (C4); Evaluate the significance and accuracy of different methods for determining critical depth (C5)
3	Concept of Uniform Flow (C2); Derivation of Uniform Flow Equations (C5); Analyze the resistance in Open Channel Hydraulics (C4); Ganguillet and Kutter Formula (C6)
4	Classify the Gradually Varied Flow Profiles (C2); Sketching of Composite Water Surface Profiles (C3); Computation of Gradually Varied Flow (C5), Derive Dynamic Equation for Steady Gradually Varied Flow (C5)

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		
Mid Semester Examination 2	▯	▯	▯	▯		
University 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:	(List of books)
	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 (Civil Engineering)**
Course Code	
Course Title	**Disaster Control and Management**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	
Course Synopsis	The course "Disaster Control and Management" provides students with a comprehensive understanding of the principles, strategies, and practices involved in mitigating, responding to, and recovering from various types of disasters. It explores the multidisciplinary nature of disaster management and emphasizes the importance of preparedness, coordination, and collaboration among stakeholders. Students will learn about risk assessment, disaster planning, emergency response systems, and post-disaster recovery strategies. The course also covers topics such as disaster communication, public policy, and ethical considerations in disaster management.

Course Outcomes:

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

CO1	Understand the concepts and principles of disaster control and management.
CO2	Identify different types of disasters and their characteristics.
CO3	Conduct risk assessments and vulnerability analyses.
CO4	Develop emergency response plans and procedures.
CO5	Coordinate and communicate effectively during emergency situations.

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
CO1	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**2**	**3**		**2**	**2**	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**2**	**3**		**2**	**2**	**3**	**3**	**2**	**3**
Average	**3**	**3**	**3**	**2.8**	**2.8**	**0.5**	**1.3**	**2.8**	**2.5**	**2.8**	**2.3**	**2.8**

Course Content:

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

Unit	Content

1	definition and classification of disasters and their impact on society (C1, C2); Comprehend the different phases involved in disaster management, including mitigation, preparedness, response, and recovery (C2); Understand the use of technology and social media as platforms for disaster communication, including their benefits and limitations (C2); Understand the roles and responsibilities of stakeholders in disaster management, including government agencies, NGOs, and local communities (C2); Analyze the characteristics and impacts of different types of disasters on individuals, communities, and infrastructure (C4); Apply the multi-hazard approach to assess the combined risks and interactions between different hazards (C3); Apply vulnerability assessment and mapping methods to identify and prioritize areas at higher risk (C3); Analyze the strengths and limitations of different risk perception and assessment techniques (C4)
2	Understand the purpose and structure of emergency management plans and frameworks (C2); Comprehend the importance of community preparedness and resilience in enhancing disaster response (C2); Comprehend the objectives and processes of search and rescue operations in emergency situations (C2); Apply the principles and components of incident command systems to establish effective command structures in emergency situations (C3); Evaluate the impact of disaster education and public awareness programs in promoting a culture of preparedness (C5);
3	Understand the purpose and methodologies of post-disaster damage assessment and needs analysis (C2); Analyze the strengths and weaknesses of recovery planning and resource allocation strategies in addressing the diverse needs of affected populations (C4); Analyze the impact of psychosocial support in facilitating the emotional and psychological recovery of individuals and communities (C4); Evaluate the efficiency and effectiveness of infrastructure restoration and rebuilding efforts in restoring essential services and enhancing resilience (C5)
4	Understand the concept of climate change and its influence on the frequency and intensity of natural hazards, and subsequently, disaster risk (C2); Utilize technological advancements in disaster management to improve response and recovery processes (C3); Analyze the future challenges and opportunities in disaster control and management to anticipate and plan for emerging trends and needs (C4)

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	6
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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 R Subramanian, Disaster Management; Vikas Publishing, ISBN : 9789352718702, year : 2018 **References**

	1. "Natural Hazards and Disaster Management: Vulnerability and Mitigation" by R B Singh 2. "Disaster mitigation: experiences and reflections" by Alka Dhameja and Pardeep Dhameja

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Earth and Environment**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	
Course Synopsis	The course brief about the natural environment encompasses all living and non-living things occurring naturally, meaning in this case not artificial. The term is most often applied to the Earth or some parts of Earth. This environment encompasses the interaction of all living species, climate, weather and natural resources that affect human survival and economic activity. This will enhance student understanding about the environmental conditions as well as resources available to us. Moreover, learner will be introduced with energy sources and alternative ways to sustain energy supply.

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

CO1	Apply the basic concepts of Environment in developing system for sustainable energy.
CO2	Manage the earth resources in a judicious way to maintain the goal of energy conservation.
CO3	To work out alternative energy sources for better future.
CO4	To maintain the continuous supply of food requirement through innovative techniques.
CO5	To work on global level platform to protect the environment at large.

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

Average	**3**	**3**	**3**	**2.8**	**2.8**	**0.5**	**1.3**	**2.8**	**2.5**	**2.8**	**2.3**	**2.8**

Course Content:

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

Unit	**Content**
1	Basic concepts of Earth and Earth systems (C1); composition and characteristics of the Biosphere and the Atmosphere (C2); Analyze the complex factors contributing to climate change and their implications for global and regional climates (C3); analyze the processes and consequences of geologic, tectonic, and biogeochemical cycles on the Earth's structure and surface (C4); Assess the significance of human actions in contributing to environmental changes and climate change (C5)
2	Recall the concept of Earth resources and different types of natural resources, such as renewable biological resources, mineral resources, air, water, and soil resources (C1); Understand the significance of natural resources for human well-being and economic development (C2); Apply sustainable practices in fisheries and forestry to ensure the long-term viability of these resources (C3); Evaluate the effectiveness of conservation strategies in maintaining the sustainability of renewable biological resources (C4); Evaluate the environmental impacts of resource use and identify strategies for minimizing pollution and ensuring resource sustainability (C4); Assess the impact of recycling efforts on reducing resource depletion and promoting sustainable resource use (C5); investigate conservation strategies that address scarcity challenges and promote the sustainable use of resources (C6)
3	Understand the concept of energy consumption and its impact on the environment (C2); Analyze the economic, social, and environmental implications of different energy resources (C4); Evaluate the efficiency and sustainability of energy consumption patterns in various sectors (C4); Evaluate the potential of future renewable energy alternatives in meeting energy demands and reducing environmental impacts (C5); Analyze the

	relationship between climate change and energy (C4); Assess the feasibility and potential benefits of future renewable energy alternatives in reducing reliance on fossil fuels (C5)
4	Concept of Environmental impact assessments, social equity, Climate change adaptation and resilience (C2); Analysis of real-world environmental issues and case studies (C4); Assess the emerging trends in earth and environmental science (C5), Assess the role of individuals and communities in promoting sustainable practices (C5); Evaluate the technical advancement role in environmental conservation (C5)

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	6
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	45

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

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

Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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 Reshaping Environments - An Interdisciplinary Approach to Sustainability in a Complex World Helena Bender (2012). **References** 1. Earth-Evolution of a Habitable World (2013) Jonathan I. Lunine. 2. Environmental Change- Key Issues and Alternative Perspectives (2005) Frank Oldfield.

SEMESTER - VI

Course Code	Course Title
	Design of Steel Structures-I
	Water Treatment & Supply Systems
	Water Treatment & Supply Systems Lab
	Highway Engineering
	Highway Engineering Lab
	Geo-Technology
	Design Lab
	Quantitative Aptitude & Logical Reasoning (MCNC)
Program Elective-IV Pool (Choose One from the pool)	
	Reinforced Concrete Structures-II
	Construction Safety
	Energy Efficient Structure
	Introduction to Smart Cities
Additional Subjects for Specialization Artificial Intelligence & Data Science	
	Data Mining
	Data Mining Lab

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Design of Steel Structures-I**
Academic Year	III
Semester	VI
Number of Credits	4
Course Prerequisite	
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	Calculate load required on structure for the design of steel structure members.
CO2	Design different type of joints and connections.
CO3	Design of tension, compression and flexural members of the steel structures.
CO4	Design beam-columns as a whole for different steel structural frame.

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
CO1	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**2**
CO2	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**2**	**2**	**2**
CO3	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**2**
CO4	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**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**

Course Content:

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

Unit	Content	Competencies
1	Properties of structural steel, Rolled steel sections as per IS specifications, factor of safety. Limit state design of Connections: welded and bolted connections, design of fillet and butt weld, eccentric connections, efficiency of joints, high tension bolts.	C1 C2 C3 C4
2	Net Sectional Area, Permissible Stress, Design of Axially Loaded Tension Member, Design of Member Subjected to Axial Tension and Bending. Column: Modes of Failure of a Column, Buckling Failure: Euler's Theory, Effective Length, Slenderness Ratio. Design of Compression Members, Design of	C1 C2 C3

	Built-Up Compression Members: Laced and Battened Columns, Design of column splice.	
3	Introduction, beam type, section classification, lateral stability of beam, lateral torsional buckling of symmetrical section, design strength of beam (Laterally supported and unsupported), shear strength and deflection, web buckling and web crippling. Design of slab base and gusset base and grillage foundation along with its connection with column.	C1 C2 C3 C4
4	Gantry Girder: Introduction, loading consideration, maximum load effect, selection of gantry girder, design of gantry girder	C1 C2 C3 C4

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	30
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	15
Problem Based Learning (PBL)	15
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						

Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	Water Treatment & Supply Systems
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
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**
CO1	**2**	**3**	**3**	**2**		**3**	**3**	**3**	**2**	**3**	**2**	**2**
CO2	**2**	**2**	**3**	**2**		**3**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**		**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**3**		**3**	**3**	**3**	**2**	**2**	**2**	**2**
Average	**2.5**	**2.8**	**3**	**2.5**		**3**	**2.8**	**3**	**2.5**	**2.8**	**2.2**	**2.5**

Course Content:

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

Unit	**Content**	**Competencies**
1	Water Quantity: Importance and necessity of water supply scheme. Water demands and its Variations. Estimation of total quantity of water requirement. Population forecasting. Selection of a	C1 C2 C3 C4

	source of water supply. Impurities in water and their sanitary significance. Physical and chemical properties of water, water quality standards.	
2	Water Treatment: Objectives, treatment processes and their sequence in conventional treatment plant, sedimentation – plain and aided with coagulation. Filtration – mechanism involved types of filters, slow and rapid sand filtration units (features and design aspects), Disinfection principles and 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.	C1 C2 C3
3	Conveyance of water, Intake structures, Rising and Gravity system, Dual systems, Pumping Systems and pumping stations, valves and appurtenances, pipe materials and pipe fitting, O&M and troubleshooting for conveyance system.	C1 C2 C3 C4
4	Layout of Distribution system – Dead End system, Grid Iron system, Ring system, Radial system, their merits and demerits Distribution Reservoir- functions and determination of storage capacity, Water Distribution Network, analysis of distribution network, layout, capacity and pressure requirements, leak detection, Maintenance, Water supply in buildings and plumbing.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)

Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	**Water Treatment & Supply Systems Lab**
Academic Year	III
Semester	VI
Number of Credits	1
Course Prerequisite	
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**
CO1	**2**	**3**	**3**	**2**		**3**	**3**	**3**	**2**	**3**	**2**	**2**
CO2	**2**	**2**	**3**	**2**		**3**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**		**3**	**3**	**3**	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**3**		**3**	**3**	**3**	**2**	**2**	**2**	**2**
Average	**2.5**	**2.8**	**3**	**2.5**		**3**	**2.8**	**3**	**2.5**	**2.8**	**2.2**	**2.5**

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.	C3, C4, C5
2.	To determine the total solids, suspended solids, dissolved solids and volatile solids in wastewater.	C1, C2, C3
3.	To determine the turbidity and specific conductivity of the given water samples.	C2, C3, C4
4.	To determine the Alkalinity of given water sample.	C2, C3, C4
5.	To determine total hardness, permanent hardness and temporary hardness for given water sample.	C2, C3, C4

6.	To determine amount of sulphates in a given sample.	C3, C4, C5
7.	To determine the optimum dosage of coagulant for turbidity removal of a given water sample.	C2, C3, C4
8.	Determination of BOD	C3, C4
9.	Determination of COD	C2, C4, C5
10.	To determine amount of Fluorides in a given sample.	C4, C5, C6

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**
Multiple Choice Questions (MCQ)	Practical Examination & Viva-voce
Viva-voce	Objective Structured Practical Examination
Objective Structured Practical Examination	
Quiz	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA	▯	▯	▯	▯		
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	▯	▯	▯	▯		
Demonstration	▯	▯	▯	▯		
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination (External Practical)	▯	▯	▯	▯		
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 (Civil Engineering)**
Course Code	
Course Title	**Highway Engineering**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
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**
CO1	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**2**	**3**		**2**	**2**	**3**	**3**	**2**	**3**
Average	**3**	**3**	**3**	**2.8**	**2.8**	**0.5**	**1.2**	**2.8**	**2.5**	**2.8**	**2.2**	**2.8**

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction to Transportation Engineering and modes of Transportation, Types of engineering surveys for highway alignment, Classification of roads. Cross sectional elements, Sight Distances: Stopping, Overtaking, Decision and Headlight Sight Distance studies.	C1 C2 C3 C4

2	Geometric design of horizontal and vertical alignment; Horizontal curve design; Super Elevation, Extra widening, Transition curves; Set back distance; Vertical curves design, design of highways/expressways.	C1 C2 C3
3	Introduction, Traffic Characteristics, Traffic study and analysis: Traffic volume study, Traffic speed study, Traffic flow characteristics, Traffic Intersection design.	C1 C2 C3 C4
4	Pavement materials – soil, aggregate, bitumen (including modified one), cement and unconventional materials- shell and block; Pavement material testing and specification. Design of flexible and rigid pavement.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						

Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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 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 **References** 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 (Civil Engineering)**
Course Code	
Course Title	**Highway Engineering Lab**
Academic Year	III
Semester	VI
Number of Credits	1
Course Prerequisite	
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**
CO1	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**			**3**	**2**	**2**	**2**	**2**
Average	**3**	**3**	**3**	**3**	**3**	**.6**	**1**	**3**	**2.3**	**2.6**	**2.3**	**2.6**

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.	C3, C4, C5
2.	Los-Angeles Abrasion Test on Aggregates.	C1, C2, C3
3.	Dorry's Abrasion Test on Aggregates.	C2, C3, C4
4.	Deval Attrition Test on Aggregates.	C2, C3, C4
5.	Crushing Strength Test on Aggregates	C2, C3, C4

6.	Penetration Index Test on Bitumen	C3, C4, C5
7.	Ductility Test on Bitumen.	C2, C3, C4
8.	Viscosity Test on Bituminous Material.	C3, C4
9.	Flash and Fire Point Test on Bitumen	C2, C4, C5
10.	Flakiness and elongation test	C4, C5, C6
11.	Marshal Stability test	
12.	C B R Value test.	

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**
Multiple Choice Questions (MCQ)	Practical Examination & Viva-voce
Viva-voce	Objective Structured Practical Examination
Objective Structured Practical Examination	
Quiz	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA	▯	▯	▯	▯		
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	▯	▯	▯	▯		
Demonstration	▯	▯	▯	▯		
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination (External Practical)	▯	▯	▯	▯		

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 (Civil Engineering)**
Course Code	
Course Title	**Geotechnology**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
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**
CO1	**3**	**3**	**3**	**2**	**2**			**2**			**3**	
CO2	**3**	**3**	**2**	**2**	**2**			**2**			**3**	
CO3	**3**	**3**	**2**	**2**	**2**			**2**				
CO4	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
Average	**3**	**3**	**2.5**	**2.2**	**2**			**2**			**2**	

Course Content:

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

Unit	**Content**	**Competencies**
1	Mohr's-Columb, Tresca and Von Mises theories. Earth Pressure- Active and Passive state of earth pressure and pressure at rest. Rankines and Columb wedge theory. Earth pressure computation for practical cases.	C1 C2 C3 C4

2	Failure of finite and infinite slopes – Swedish circle method, Friction Circle method, Taylors stability number and stability curves, Factor of safety, slope stability of earth dams, introduction to Bishop's method.	C1 C2 C3
3	Bearing capacity- Minimum depth of foundation, Failure theories, Meyerhof's analysis, different equations for bearing capacity, effect of water table on bearing capacity. IS code method for computing bearing capacity. Shallow Foundations: Safe bearing capacity, Settlement of footings - immediate and time dependent settlement, permissible limits, differential settlement. 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 test on piles as per BIS codes. Classification and selection of under reamed pile.	C1 C2 C3 C4
4	Objective of site investigation, reconnaissance, detailed site investigation, methods of exploration, geophysical methods, seismic refraction survey. Depth of exploration, selection of foundation, plate load test, standard penetration test.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	**Design Lab**
Academic Year	III
Semester	VI
Number of Credits	2
Course Prerequisite	
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**
CO1	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**3**	**1**	**1**	**2**	**3**
CO2	**1**	**3**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**1**
CO3	**2**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**1**
CO4	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**1**	**2**	**1**	**1**
Average	**2.25**	**3**	**2.25**	**2.25**	**2**	**2.5**	**1.5**	**2**	**1.75**	**2.25**	**1.5**	**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	C3, C4, C5
2.	Various finite elements and cross-sectional shapes	C1, C2, C3
3.	Model Generation	C2, C3, C4

4.	Geometry Operations	C2, C3, C4
5.	Two-Dimensional Portal frame under vertical and horizontal loads	C2, C3, C4
6.	Analysis of Continuous beam	C3, C4, C5
7.	Truss Analysis	C2, C3, C4
8.	Roof Truss Analysis	C3, C4

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**
Multiple Choice Questions (MCQ)	Practical Examination & Viva-voce
Viva-voce	Objective Structured Practical Examination
Objective Structured Practical Examination	
Quiz	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA	▯	▯	▯	▯		
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	▯	▯	▯	▯		
Demonstration	▯	▯	▯	▯		
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination (External Practical)	▯	▯	▯	▯		
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

Program Elective - IV

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Reinforced Concrete Structures-II**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
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**
CO1	**3**	**3**	**3**	**2**	**2**			**2**			**3**	
CO2	**3**	**3**	**2**	**2**	**2**			**2**			**3**	
CO3	**3**	**3**	**2**	**2**	**2**			**2**				
CO4	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
Average	**3**	**3**	**2.5**	**2.2**	**2**			**2**			**2**	

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction, Components of flat slab, Design of flat slab by direct and equivalent frame method based on IS: 456-2000, Opening in flat slab and detailing of reinforcement. Beam curved in plan: Design and analysis of beam curved in plan supported symmetrically, design of semi-circular beam for different supports conditions, Torsion Factor, Stress due to torsion, reinforcement required for torsion. Recommendation of IS: 456.	C1 C2 C3 C4

2	Dome: Introduction, Stresses in spherical dome due static and wind load, Design of RCC spherical dome. Circular Tank: Introduction, General design requirements according to IS: 3370-II. Joints in water tank, circular tank with flexible joint between floor and wall as well as rigid joint between floor and wall. IS code provisions for circular tank Rectangular Tank: Introduction, Approximate method and exact method, Underground tank: Introduction, earth pressure and uplift pressure on wall and floor respectively, design of rectangular tank.	C1 C2 C3
3	Introduction, Jannsen's and Airy's Theory, Rectangular and Circular water tank. Design of bunker, Conical and Pyramidal hoppers.	C1 C2 C3 C4
4	Basic concepts – Advantages – Materials required – Systems and methods of pre-stressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long-term deflections -Losses of pre-stress – Estimation of crack width.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce

	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		
Mid Semester Examination 2	▯	▯	▯	▯		
University 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 R.C.C Designs by B.C. Punmia and A.K. Jain, Laxmi Publication. **Reference Books** 1. Design of Reinforced Concrete Structures, P.Dayaratnam, Oxford& IBH Publication New Delhi. 2. Reinforced Concrete-Limit State Design, A.K. Jain, Nem Chand & Bros., Roorkee.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Construction Safety**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
Course Synopsis	The course "Construction Safety" provides students with an in-depth understanding of safety practices and regulations in the construction industry. It focuses on identifying and mitigating potential hazards, promoting a culture of safety, and implementing effective safety management systems. Students will learn about the principles of occupational safety and health, hazard recognition and control, construction site safety planning, and incident investigation. The course emphasizes the importance of proactive safety measures and equips students with the knowledge and skills to ensure a safe working environment on construction sites.

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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**	**3**	**2**	**2**			**2**			**3**	
CO2	**3**	**3**	**2**	**2**	**2**			**2**			**3**	
CO3	**3**	**3**	**2**	**2**	**2**			**2**				
CO4	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
CO5	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
Average	**3**	**3**	**2.5**	**2.2**	**2**			**2**			**2**	

Course Content:

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

Unit	Content	Competencies
1	Importance of construction safety, Legal and regulatory requirements, Safety culture and leadership, Roles and responsibilities of key stakeholders, Fundamentals of occupational safety and health, Hazard identification	C1 C2 C3 C4

	and risk assessment, Safety training and education, Personal protective equipment (PPE) and its proper use.	
2	Construction site hazards and risk management, Safety planning and hazard control strategies Emergency preparedness and response planning, Permit-to-work systems, Fall hazards in construction and prevention measures, Scaffolding types, inspection, and safe use, Personal fall arrest systems, Design considerations for safe working at heights.	C1 C2 C3
3	Electrical hazards and precautions, Lockout/tagout procedures, Grounding and bonding requirements, Safe use of electrical tools and equipment, Excavation hazards and protective systems, Soil classification and stability analysis, Sloping, benching, and shoring techniques, Confined space entry procedures.	C1 C2 C3 C4
4	Identification and handling of hazardous materials, Chemical labelling and safety data sheets (SDS), Safe storage and disposal of hazardous substances, Communication of hazards and safety information, Safe operation of construction machinery, Equipment inspection and maintenance, Crane safety and rigging practices, Traffic control and vehicle safety on construction sites, Sustainable construction practices and safety considerations, Psychological and mental health in construction safety	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)

	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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 Kumar Neeraj Jha/ Dilip A Patel/ Amarjit Singh, Construction safety management, 1st edition, Pearson Publication. **Reference Books** 1. Allan St John Holt BA, FIOSH, RSP, Principles of Construction Safety, ISBN:9780632056828 2. Richard Coble, Construction Safety and Health Management

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Energy Efficient Structure**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**	**3**	**2**	**2**			**2**			**3**	
CO2	**3**	**3**	**2**	**2**	**2**			**2**			**3**	
CO3	**3**	**3**	**2**	**2**	**2**			**2**				
CO4	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
CO5	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
Average	**3**	**3**	**2.5**	**2.2**	**2**			**2**			**2**	

Course Content:

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

Unit	**Content**	**Competencies**
1	Importance of energy efficiency in the built environment, Energy codes, standards, and certifications, Life cycle assessment and embodied energy, Principles of sustainable building design, Energy audits and benchmarking, Data collection and	C1 C2 C3 C4

	analysis of energy usage, Energy monitoring and metering techniques, Energy performance indicators and metrics.	
2	Heat transfer mechanisms in buildings, Insulation materials and techniques, Fenestration design and selection, Air sealing and thermal bridging mitigation, Types of HVAC systems and their energy efficiency characteristics, Load calculations and system sizing, Energy-efficient equipment selection, Control strategies for optimized HVAC performance.	C1 C2 C3
3	Principles of daylighting and its benefits, Design strategies for maximizing natural light, Energy-efficient lighting technologies and fixtures, Lighting control systems and daylight harvesting techniques, Solar energy systems for electricity generation and heating, Wind energy and geothermal systems, Integration of renewable energy technologies into building design, Economic and environmental considerations.	C1 C2 C3 C4
4	Retrofit strategies for improving energy efficiency in existing buildings, building envelope upgrades and retrofit techniques, HVAC system retrofit options, Case studies of successful building retrofit projects, green building certification systems (e.g., LEED, BREEAM), Water conservation strategies and technologies, Indoor environmental quality and occupant comfort, Life cycle costing and sustainable materials selection.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)

Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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 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 (Civil Engineering)**
Course Code	
Course Title	**Introduction to Smart Cities**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	
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
CO1	**3**	**3**	**3**	**2**	**2**			**2**			**3**	
CO2	**3**	**3**	**2**	**2**	**2**			**2**			**3**	
CO3	**3**	**3**	**2**	**2**	**2**			**2**				
CO4	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
CO5	**3**	**3**	**3**	**3**	**2**			**2**			**2**	
Average	**3**	**3**	**2.5**	**2.2**	**2**			**2**			**2**	

Course Content:

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

Unit	Content	Competencies
1	Definition and characteristics of smart cities, Evolution and global trends in smart city development, Benefits and challenges of smart cities, Smart city frameworks and models, Digital governance and e-government	C1 C2 C3 C4

	services, Open data and transparency in smart cities, Citizen participation and co-creation, Privacy and data security considerations.	
2	Intelligent transportation systems, Smart buildings and infrastructure, Water and waste management in smart cities, Sustainable urban planning and design, Intelligent transportation systems (ITS), Connected and autonomous vehicles, Multi-modal transportation solutions, Traffic management and congestion reduction.	C1 C2 C3
3	Energy-efficient systems and renewable energy integration, Smart grids and energy management, Demand response and energy conservation, Sustainable urban energy planning, Internet of Things (IoT) and sensor network, Big data analytics and machine learning, Artificial intelligence (AI) and predictive analytics, Blockchain technology for smart city applications.	C1 C2 C3 C4
4	Sustainable development goals and smart cities, Climate change adaptation and mitigation, Resilience planning and disaster management, Circular economy and waste management, Analysis of successful smart city projects, international comparisons and benchmarking, Social and ethical considerations, Economic and policy challenges, Future directions and opportunities for smart city development.	C1 C2 C3 C4

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)

Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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 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

SEMESTER - VII

Course Code	Course Title
	Irrigation Engineering
	Estimation & Costing
	Construction Project Management
	Construction Project Management Lab
	Capstone Project
	Valuation & Costing Lab
	Industrial Training - II
Program Elective-V Pool (Choose One from the pool)	
	Bridge Engineering
	Ground water engineering
	Railways, Tunnel and Airport Engineering
	Waste water treatment
Additional Subjects for Specialization Artificial Intelligence & Data Science	
	Data Visualization
	Data Visualization Lab

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Irrigation Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	
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**
CO1	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**
CO3	**3**	**3**	**3**	**3**	**1**	**2**	**1**				**2**	
CO4	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**			**2**
Average	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**

Course Content:

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

Unit	Content	Competencies
1	Irrigation requirements in India: Scope, Soil moisture & Plant growth, crop water requirements, Irrigation Scheduling, Irrigation efficiencies, Duty-Delta-base period & relation between them, Surface & subsurface irrigation method, Irrigation water Quality.	C1 C2 C3 C4
2	Introduction, layout of diversion headwork and its component, khosla's theory and concept of flow net, safe exit gradient, hydraulic design of weir on Bligh's theory and design of modern barrage on khosla's theory. Necessity& functioning of silt excluder & silt extractor.	C1 C2 C3

3	Classification and selection of cross drainage work, hydraulic design aspects of aqueduct and syphon aqueduct. Canal falls: Necessity and classification of canal falls, hydraulic design of Sarda type and a Straight Glacis fall.	C1 C2 C3 C4
4	Necessity and classification of Dams, Selection of site of Dam. Gravity Dam: Introduction, Forces acting on Dam, Stability criterion, Elementary profile of dam, Drainage gallery, Hydraulic design of gravity dam. Earth Dam: Introduction, design principle, seepage throughout dam, seepage line, control of seepage, and design of filter. Necessity and classification of Spillway, essential requirements of spillways capacity and their suitability, Hydraulic design of Ogee spillway.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		

Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. Irrigation Engineering and Hydraulic Structures (2011) 24th edition, ISBN No. 81-7409-047-9, S.K. Garg, Khanna Publications. **Referance 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 (Civil Engineering)**
Course Code	
Course Title	**Estimation & Costing**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	
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**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Principle of estimation, units, item work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two room building, multi storey buildings, with different	C1 C2 C3 C4

	sections of walls ,foundation, floors and roofs, R.B and R.C.C works, Plastering, white washing, Distempering and painting, doors and windows, lump sum items, Estimates of canals, dams, barrages, Hilly roads etc.	
2	Necessity of specification types of specification, general specification, specification of bricks, cement, sand, water, lime, reinforcement, detailed specification for earthwork, cement, concrete, brickwork, flooring, D.P.C, R.C.C, cement plastering, white and color washing, distempering, painting.	C1 C2 C3
3	Purpose, importance and requirements of rate analysis, units of measurement preparation of rate analysis. Procedure of rate analysis for items: Earth work, concrete works, R.C.C works, reinforce brick work, plastering, painting, finishing (white washing, distempering).	C1 C2 C3 C4
4	Tender and acceptance of tender, Earnest money, security money, retention money, measurement book, cash book, preparation, examination and payment of bills, first and final bills, administrative sanction, technical sanction. Billing: maintenance of muster role, preparation of pay bill, measurement of work for payment of contractors. Different types of payment: first & final, running advance and final payment. Valuation: Purpose of valuation, principles of valuation depreciation, sinking fund, salvage& scrap value, valuation of a building: cost method, rental –return method.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation

Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. Dutta BN, Estimating &costing(2013), 27th Edition, ISBN No. 978-81-7476-729-5, UBS Publications **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.

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Construction Project Management**
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	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**	**PO10**	**PO11**	**P012**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Foundations of Project Management, Project Life Cycle, Project Environment, Project Selection, Project Proposal, Project Scope	C1 C2 C3 C4
2	The Breakdown Structure. Network Scheduling, Critical Path Method, Program Evaluation & Review Technique, Planning and Scheduling of Activity Networks, Assumptions in PERT	C1 C2 C3
3	Modeling, Time-cost Trade-offs, Linear Programming and Network Flow Formulations, PERT/COST Accounting.	C1 C2 C3 C4

4	Scheduling with limited resources, Resource Planning, Resource Allocation, Project Schedule Compression, Project Scheduling Software, Precedence Diagrams, Decision CPM, Generalized Activity Networks, GERT	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	▯	▯	▯	▯		
Unit test	▯	▯	▯	▯		
Practical Log Book/ Record Book						
Mid Semester Examination 1	▯	▯	▯	▯		
Mid Semester Examination 2	▯	▯	▯	▯		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	**Construction Project Management Lab**
Academic Year	4
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	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**	**PO10**	**PO11**	**P012**
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**	**3**	**3**	**3**				**3**	**2**	**3**	
CO3	**3**	**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**			**3**	
CO5	**3**	**3**	**3**	**3**		**3**		**2**			**1**	
Average	**3**	**3**	**3**	**3**	**1.2**	**1.6**		**0.8**	**0.6**	**0.4**	**1.4**	

Course Content:

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

Experiment No.	**Content**	**Competencies**
1.	Study of Foundations of Project Management.	C3, C4, C6
2.	Study of Project Selection, Project Proposal, Project Scope.	C3, C4, C6
3.	Study of Critical Path Method.	C3, C4, C6
4.	Evaluation by Program Evaluation & Review Technique.	C3, C4, C6
5.	Networking for Planning and Scheduling of Activity Networks.	C3, C4, C6

6.	Scheduling with limited resources, Resource Planning, Resource Allocation.	C3, C4, C6
7.	Project Scheduling Software, Precedence Diagrams.	C3, C4, C6
8.	Introduction to Microsoft Project	C3, C4, C6
9.	Application of Microsoft project in different projects- Case Study	C3, C4, C6

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Quiz						
VIVA	☐	☐	☐	☐	☐	☐
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐

Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐	☐	☐
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 (Civil Engineering)**
Course Code	
Course Title	**Valuation & Costing Lab**
Academic Year	4
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**
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**	**3**	**3**	**3**				**3**	**2**	**3**	
CO3	**3**	**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**			**3**	
Average	**3**	**3**	**3**	**3**	**1.2**	**1.6**		**0.8**	**0.6**	**0.4**	**1.4**	

Course Content:

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

Experiment No.	**Content**	**Competencies**
1.	Estimation of building (long wall and short wall method)	C3, C4, C6
2.	Estimation of building (center line method)	C3, C4, C6
3.	Analysis of rate for concrete work	C3, C4, C6
4.	Analysis of rate for brick work	C3, C4, C6
5.	Analysis of rate for plaster work	C3, C4, C6
6.	Estimate quantity of reinforcement	C3, C4, C6

7.	Preparation for approximate estimate for road project	C3, C4, C6
8.	Estimating cost of building on plinth area method	C3, C4, C6

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Quiz						
VIVA	☐	☐	☐	☐	☐	☐
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination(External Practical)	☐	☐	☐	☐	☐	☐

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	

Program Elective - V

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	**Bridge Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	
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**
CO1	**2**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**1**
CO2	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**3**	**1**	**1**	**2**	**3**
CO3	**2**	**2**	**3**	**1**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**1**
CO4	**3**	**1**	**1**	**2**	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**3**
CO5	**2**	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**2**	**3**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**

1	Introduction-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-General Design Requirements	C1 C2 C3 C4
2	Introduction-Method of Analysis and Design Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy	C1 C2 C3
3	Basic principles-General Design Requirements-Mild steel reinforcement in prestressed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams Composite Section-Propped-Design of Propped Composite Section-Unpropped composite section-Two stage Prestressing - Shrinking stresses-General Design requirements for Road Bridges.	C1 C2 C3 C4
4	Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments-Design loads for Abutments.	C1 C2 C3 C4

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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 Victor (2012) "Essentials of Bridge Engineering"7th 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.

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

Course Content:

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

Unit	Content	Competencies
1	Introduction to Hydrologic cycle – Origin and Age of groundwater, classification of groundwater, aquifer - water table - Darcy's Law, Coefficient of Transmissibility and storage - Flow rates and equation.	C1 C2 C3 C4
2	Geophysical methods, study of radial flow - well flow, Multiple well system - characteristic well losses, open well, tube well, well depth, well screen - head losses	C1 C2 C3

	through the screen gravel packing and formation stabilization.	
3	Definition of terms - static water level, pumping level, drawdown – residual, drawdown pumping rate - automatic water level recorder- time drawdown analysis - distance drawdown analysis, Jacob's methods, pumping test methods.	C1 C2 C3 C4
4	Injection methods-monitoring: - Cement lime, Lime-fly ash and chemical stabilization, Deep mixing techniques. Hydrological equilibrium - rain gauge network, runoff procedure for conducting infiltration test – artificial recharge, rainwater harvesting – calculation of groundwater storage capacity and groundwater potential.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						

Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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 (Civil Engineering)**
Course Code	
Course Title	**Railways, Tunnel and Airport Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	
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.
CO5	Analyse and design airport runways, taxiways, and aprons.

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**
CO1	**2**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**1**
CO2	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**3**	**1**	**1**	**2**	**3**
CO3	**2**	**2**	**3**	**1**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**1**
CO4	**3**	**1**	**1**	**2**	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**3**
CO5	**3**	**1**	**1**	**2**	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**3**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Railway alignment and surveying, Track components and geometry, Track design and maintenance, Classification and types of tunnels, Tunnel construction methods, Tunnel design considerations.	C1 C2 C3 C4

2	Tunneling Methods: Types and purpose of tunnels; factors affecting choice of excavation technique; Methods – soft ground tunneling, hard rock tunneling, shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered in tunneling and remedial measures.	C1 C2 C3
3	Airport master planning, Airside and landside components, Environmental considerations in airport planning, Runway geometry and safety considerations, Pavement design and materials.	C1 C2 C3 C4
4	Construction techniques for runways, Passenger terminal functions and layout, Baggage handling systems, Terminal building design and architecture.	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	

Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University 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.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 (Civil Engineering)**
Course Code	
Course Title	**Waste water treatment**
Academic Year	IV
Semester	VII
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**
CO1	**2**	**2**	**1**	**1**	**1**	**2**	**3**	**1**	**1**	**2**	**3**	**1**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**1**
CO4	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**3**	**1**	**1**	**2**	**3**
CO5	**1**	**3**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction: Wastewater flow and its characteristics, Wastewater collection systems, Estimation and variation of wastewater flows. Problems of industrial wastewaters, Sampling protocol, Equalization, Neutralization, Proportioning processes, Volume and	C1 C2 C3 C4

	strength reduction. Preliminary, primary, secondary and tertiary wastewater treatment processes. Theory and design of screens, grit chambers, sedimentation, coagulation, flocculation.	
2	Physio-chemical and biological treatment strategies and their evaluation, Theory of activated sludge process (ASP), extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactor, rotating biological contactor, etc., Mass balancing in ASP and TF and their design.	C1 C2 C3
3	Anaerobic treatment process, Effects of pH, temperature and other parameters on anaerobic treatment, Concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor.	C1 C2 C3 C4
4	Indian standards for disposal of treated wastewaters on land and in natural streams, Treated wastewater reclamation and reuse, Introduction to duckweed pond, vermiculture and root zone technology for wastewater treatment, Recent technologies of treatment. Study on wastewater generation points, wastewater characteristics, Treatment scheme for tannery, sugar, textile, steel, distillery, paper/ pulp and oil refinery industry wastewater. Exposure to applications based on current industrial trends.	C1 C2 C3 C4

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)

Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐	☐	
Unit test	☐	☐	☐	☐	☐	
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐	☐	
Mid Semester Examination 2	☐	☐	☐	☐	☐	
University Examination	☐	☐	☐	☐	☐	

Feedback Process	3. Student's Feedback
Students Feedback is taken through various steps 4. Regular feedback through Mentor Mentee system 5. Feedback between the semester through google forms	

References:	(List of books)
	Text Books 2. 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.

SEMESTER - VIII

Course Code	Course Title
	Earthquake Engineering
	Entrepreneurship & Digital Product Management
	Simulation Lab
	Research Project/ Dissertation
Program Elective-V Pool (Choose One from the pool)	
	Structural Dynamics
	Stochastic Hydrology
	New Age Transit System
	Urban environmental quality Management

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
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**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction to Dynamic Loads: Static Load v/s Dynamic Load, Types of Dynamic forces, Force Control and Displacement Control	C1 C2 C3 C4
2	Basics of Seismology: Earth and its interior, Plate Tectonics, Convection Currents, The Earth quake, Inter Plate Earthquake (Convergent Boundaries, Divergent Boundaries and Transform Boundaries), Intra Plate	C1 C2 C3

	Earthquake (Faults and Types of Faults), Seismic Waves, Basic Terminology, Measuring Units and Instruments	
3	Behavior of RC Structures during earthquake: Load Transfer Path, Strength Hierarchy, Reversal of Stresses, Importance of Beam Column Joints, Importance of Stiffness and Ductility (Capacity Design Concept) in Structures, Effect of Short Column, Effect of Soft Storey, Improper Detailing, Effect of Masonry Infill Walls, Effect of Eccentricity, Effect of Pounding, Effect of Floating Columns, Effect of Flexibility and Effects of Setbacks, Earthquake Resistant Features of RC Structures	C1 C2 C3 C4
4	Equation of Motion (By Newton's Law and By D'Alembert's Principle), Degrees of Freedom, Simplified Single Degree of Freedom, Mathematical Modeling, Equation of Motion for Free Vibration for Damped and Un damped System (Single Degree of Freedom System), Equation of Motion for Forced Vibration for Damped and Un damped System (Single Degree of Freedom System), Logarithmic Decrement	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Case study	University Examination
Quiz	Short Answer Questions (SAQ)
Seminars	Long Answer Question (LAQ)
Problem Based Learning (PBL)	

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	**Simulation Lab**
Academic Year	4
Semester	VII
Number of Credits	2
Course Prerequisite	
Course Synopsis	Understanding the different simulation tools for the analysis and design of various structures.

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

CO1	Analysis and design of structures
CO2	Analysis of structure against dynamics forces
CO3	Analysis and design of foundation
CO4	Analysis and design of pavement

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**
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**	**3**	**3**	**3**				**3**	**2**	**3**	
CO3	**3**	**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**			**3**	
Average	**3**	**3**	**3**	**3**	**1.2**	**1.6**		**0.8**	**0.6**	**0.4**	**1.4**	

Course Content:

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

Experiment No.	**Content**	**Competencies**
1.	Analysis and Design of single storey and multi-storey frame	C3, C4, C6
2.	Wind load analysis on RCC and steel building	C3, C4, C6
3.	Analysis and Design of multi-storeyed building	C3, C4, C6
4.	Analysis and design of steel truss	C3, C4, C6
5.	Analysis of bridge deck	C3, C4, C6
6.	Analysis and design of shallow footing	C3, C4, C6
7.	Analysis and design of deep footing	C3, C4, C6
8.	Analysis and Design of flexible pavement	C3, C4, C6
9.	Analysis and Design of rigid pavement	C3, C4, C6

10.	Design of wastewater treatment system	C3, C4, C6

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Quiz						
VIVA	□	□	□	□	□	□
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	□	□	□	□	□	□
Demonstration	□	□	□	□	□	□
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination (External Practical)	□	□	□	□	□	□

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 (Civil Engineering)**
Course Code	
Course Title	**Entrepreneurship & Digital Product Management**
Academic Year	4
Semester	VIII
Number of Credits	2
Course Prerequisite	
Course Synopsis	This lab course is designed to provide students with hands-on experience in entrepreneurship and digital product management. Students will work on real-world projects and develop practical skills in identifying opportunities, building and managing digital products, and launching successful ventures. Through a combination of lectures, case studies, and practical exercises, students will gain a deep understanding of the entrepreneurial process and the principles of effective product management.

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

CO1	Understand the fundamentals of entrepreneurship and digital product management
CO2	Develop skills in identifying market opportunities and conducting market research
CO3	Understand the process of launching and scaling a digital product.
CO4	Foster a mindset of innovation, creativity, and problem-solving.

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**
CO1	**3**	**3**	**3**	**3**								
CO2	**3**	**3**	**3**	**3**	**3**				**3**	**2**	**3**	
CO3	**3**	**3**	**3**	**3**	**3**	**2**						
CO4	**3**	**3**	**3**	**3**		**3**		**2**			**3**	
Average	**3**	**3**	**3**	**3**	**1.2**	**1.6**		**0.8**	**0.6**	**0.4**	**1.4**	

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 digital product management and its key principles	C3, C4, C6
2.	Opportunity Identification and Market Research	C3, C4, C6
3.	Identifying market gaps and opportunities	C3, C4, C6

4.	Conducting market research and competitive analysis	C3, C4, C6
5.	Product Design and User Experience (UX) Design	C3, C4, C6
6.	Conducting usability testing and gathering user feedback	C3, C4, C6
7.	Managing development cycles and iterative product improvement	C3, C4, C6
8.	Testing and quality assurance (QA) processes	C3, C4, C6
9.	Product launch strategies and go-to-market planning	C3, C4, C6
10.	Developing an entrepreneurial mindset and cultivating creativity	C3, C4, C6
11.	Effective communication and storytelling techniques	C3, C4, C6
12.	Ethical Considerations in Entrepreneurship and Product Management	C3, C4, C6
13.	Privacy, data protection, and responsible product design	C3, C4, C6
14.	Social impact and sustainability considerations	C3, C4, C6

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
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Viva-voce	Mid Semester Examination 2
Objective Structured Practical Examination	University Examination
Quiz	Dissertation
Seminars	Multiple Choice Questions (MCQ)
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)
	Practical Examination & Viva-voce
	Objective Structured Practical Examination

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4	CO5	CO6
Quiz						
VIVA	☐	☐	☐	☐	☐	☐
Assignment / Presentation						
Unit test						
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐
Mid Semester Examination 1						
Mid Semester Examination 2						
University Examination (External Practical)	☐	☐	☐	☐	☐	☐

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

Program Elective - VI

Faculty of Engineering & Technology	
Name of the Department	**Civil Engineering**
Name of the Program	**Bachelor of Technology (Civil Engineering)**
Course Code	
Course Title	Structural Dynamics
Academic Year	IV
Semester	VIII
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**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction to Structural Dynamics: Basic concepts and terminology, Types of dynamic loads Importance of structural dynamics in engineering	C1 C2 C3 C4

2	Single Degree of Freedom Systems: Free vibration of single-degree-of-freedom systems, Response to harmonic excitation, Response to transient excitation Multi-Degree of Freedom Systems: Introduction to multi-degree-of-freedom systems, Modal analysis Equations of motion and eigenvalue problems	C1 C2 C3
3	Vibration Analysis Techniques: Free vibration analysis using matrix methods, forced vibration analysis using matrix methods, Mode superposition methods. Continuous Systems: Introduction to continuous systems, Vibration of strings and bars, Vibration of beams and plates	C1 C2 C3 C4
4	Dynamic Response of Structures: Dynamic analysis of structures, Influence of damping on structural response, Response spectrum analysis, Dynamic response of reinforced concrete structures Behavior of reinforced concrete under dynamic loads Design considerations for dynamic loads	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Problem Based Learning (PBL)	Mid Semester Examination 2
Journal Club	University Examination
Quiz	Short Answer Questions (SAQ)
Seminars	Long Answer Question (LAQ)

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		

Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	Stochastic Hydrology
Academic Year	IV
Semester	VIII
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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction to Stochastic Hydrology: Basic concepts and terminology, Importance of stochastic hydrology in engineering and water resources management. Probability and Statistics Review: Review of probability theory and statistical distributions, Descriptive statistics and exploratory data analysis	C1 C2 C3 C4
2	Hydrological Data Analysis: Data collection and preprocessing, Data visualization and summary statistics, Hypothesis testing and goodness-of-fit tests	C1 C2 C3

3	Stochastic Processes in Hydrology: Introduction to stochastic processes, Markov chains and applications in hydrology, Time series analysis and modeling	C1 C2 C3 C4
4	Frequency Analysis of Hydrological Events: Return period and exceedance probability, Probability distributions for hydrological variables, Methods for frequency analysis Flood Frequency Analysis: Index flood method, Log-Pearson Type III distribution, Flood frequency estimation and prediction	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Seminars	Mid Semester Examination 2
Problem Based Learning (PBL)	University Examination
Journal Club	Short Answer Questions (SAQ)
	Long Answer Question (LAQ)

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		

Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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 (Civil Engineering)**
Course Code	
Course Title	New Age Transit System
Academic Year	IV
Semester	VIII
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**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction to New Age Transit Systems: Definition and characteristics of new age transportation, Overview of emerging trends, technologies, and disruptions in the transportation industry, Socioeconomic and environmental factors driving the need for new age transportation	C1 C2 C3 C4
2	Intelligent Transportation Systems (ITS): ITS components and technologies, Traffic management	C1 C2

	systems and applications, Intelligent infrastructure and vehicle-to-infrastructure communication	C3
3	Electric and Autonomous Vehicles: Electric vehicle (EV) technology and infrastructure, Autonomous vehicle (AV) technology and levels of autonomy, Implications and challenges of EV and AV adoption Shared Mobility and Transportation as a Service (TaaS): Concepts and models of shared mobility, On-demand ride-hailing platforms and car-sharing services, Impacts of shared mobility on transportation efficiency and sustainability	C1 C2 C3 C4
4	Sustainable Transportation Solutions: Alternative fuels and energy sources for transportation, Sustainable urban transportation planning and design, Multi-modal transportation systems and integration	C1 C2 C3 C4

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**
Multiple Choice Questions (MCQ)	Mid Semester Examination 1
Quiz	Mid Semester Examination 2
Seminars	University Examination
Problem Based Learning (PBL)	Short Answer Questions (SAQ)
Journal Club	Long Answer Question (LAQ)

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**		
Quiz						
VIVA						
Assignment / Presentation	☐	☐	☐	☐		

Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. 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 (Civil Engineering)**
Course Code	
Course Title	Urban Environmental Quality Management
Academic Year	IV
Semester	VIII
Number of Credits	3
Course Prerequisite	Environmental Engineering
Course Synopsis	This course introduces students to the principles, strategies, and tools for managing and improving the quality of the urban environment. It covers various aspects of urban environmental management, including air and water quality, waste management, green spaces, and sustainable urban planning. The course focuses on understanding the challenges of urbanization and developing practical solutions for creating healthy and sustainable cities.

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

CO1	Demonstrate knowledge and understanding of the concepts and principles of urban environment quality management
CO2	Identify and describe the key factors and components influencing urban environmental quality
CO3	Analyze and evaluate the impacts of urban development on the environment and human health
CO4	Apply appropriate strategies and tools for managing and improving urban environmental quality

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**
CO1	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**
Average	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**

Course Content:

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

Unit	**Content**	**Competencies**
1	Introduction to Urban Environment Quality Management: Definition and scope of urban environment quality management, Key challenges and issues in managing urban environmental quality, Overview of sustainable development and its relevance to urban environments	C1 C2 C3 C4

2	Urban Air Quality Management: Sources and impacts of air pollution in urban areas, Air quality monitoring and assessment techniques, Strategies for air pollution control and mitigation in cities.	C1 C2 C3
3	Urban Water Quality Management: Water pollution sources and challenges in urban areas, Water quality monitoring and assessment methods, Approaches to urban water pollution prevention and management	C1 C2 C3 C4
4	Urban Noise and Vibrations Management: Sources and effects of urban noise and vibrations, Noise monitoring and assessment techniques, Noise control and mitigation measures in urban environments. Innovative Solutions for Urban Environment Quality: Smart technologies and data-driven approaches for urban environmental management, Case studies of innovative urban environmental projects and initiatives, Role of citizen engagement and community participation in improving urban environment quality	C1 C2 C3 C4

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
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Case/Project Based Learning (CBL)	--
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Mapping of Assessment with COs

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

VIVA						
Assignment / Presentation	☐	☐	☐	☐		
Unit test	☐	☐	☐	☐		
Practical Log Book/ Record Book						
Mid Semester Examination 1	☐	☐	☐	☐		
Mid Semester Examination 2	☐	☐	☐	☐		
University 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. Urban Environmental Management and Technology" by Kevin Nelson **Reference Books** 1 Urban Ecology: Science of Cities" by Richard T. T. Forman 2.Urban Air Pollution: Monitoring and Control Strategies" by Xavier Querol and Augustin Colette 3. Urban Water Management: Science, Technology, and Service Delivery" by Neelam Patel and Ashok V. Desai 4. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia" by Anthony M. Townsend