Faculty of Engineering & Technology

Department of Civil Engineering

4-Year Full Time Education Program

Bachelor of Technology in Civil Engineering (Artificial Intelligence and Data Science)

With effect from Year 2024

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1. NATURE AND EXTENT OF THE PROGRAM

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

Here are some key aspects of the Bachelor of Technology in Civil Engineering program:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2. PROGRAM EDUCATION OBJECTIVES (PEOs)

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

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

3. GRADUATE ATTRIBUTES

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

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

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

4. QUALIFICATION DESCRIPTORS:

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

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

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

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

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

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

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

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

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

5. PROGRAM OUTCOME

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

6. PROGRAM SPECIFIC OUTCOME

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

7. COURSE STRUCTURE

SEMESTER – I

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130101111	Engineering Mathematics-I	3	0	0	3	**40**	**60**	**100**
130101112	Programming for Problem Solving	2	0	0	2	**40**	**60**	**100**
130101113	Programming for Problem Solving Lab	0	0	4	2	**20**	**30**	**50**
130101114	Engineering Workshop	1	0	0	1	**40**	**60**	**100**
130101115	Engineering Workshop Lab	0	0	4	2	**20**	**30**	**50**
130101116	Design Thinking	0	0	4	2	**20**	**30**	**50**
	MGE-I	4	0	0	4	**40**	**60**	**100**
	VAC-I	2	0	0	2	**20**	**30**	**50**
	AECC-I	2	0	0	2	**20**	**30**	**50**
	Total	**14**	**0**	**12**	**20**	**260**	**390**	**650**

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SEMESTER – II

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130102111	Engineering Mathematics-II	3	0	0	3	**40**	**60**	**100**
130102112	Basics of Electrical & Electronics Engineering	2	0	0	2	**40**	**60**	**100**
130102113	Basics of Electrical & Electronics Engineering Lab	0	0	4	2	**20**	**30**	**50**
130102114	Engineering Graphics and Design	1	0	0	1	**40**	**60**	**100**
130102115	Engineering Graphics and Design Lab	0	0	4	2	**20**	**30**	**50**
130102116	New Age Skills	0	0	4	2	**20**	**30**	**50**
	MGE-II	4	0	0	4	**40**	**60**	**100**
	VAC-II	2	0	0	2	**20**	**30**	**50**
	AECC-II	2	0	0	2	**20**	**30**	**50**
	Total	**14**	**0**	**12**	**20**	**260**	**390**	**650**

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SEMESTER – III

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130103111	Strength of Materials	3	0	0	3	**40**	**60**	**100**
130103112	Strength of Materials Lab	0	0	2	1	**20**	**30**	**50**
130103113	Surveying	2	0	0	2	**40**	**60**	**100**
130103114	Surveying Lab	0	0	4	2	**20**	**30**	**50**
	SEC-I (Civil Engineering Drawing Lab)	0	0	4	2	**20**	**30**	**50**
	MGE-III	4	0	0	4	**40**	**60**	**100**
	VAC-III	2	0	0	2	**20**	**30**	**50**
	AECC-III	2	0	0	2	**20**	**30**	**50**
130103116	Summer Internship	0	0	2	1	**20**	**30**	**50**
Program Elective-I Pool (Choose One from the pool)								
130103117	Civil Infrastructure and Society	3	0	0	3	**40**	**60**	**100**
130103115	Building Construction & Material							
130103119	Introduction to Sustainable development							
130103120	Air, Noise Pollution and Control							
	Total	16	0	12	**22**	**280**	**420**	**700**
Additional Credits for Specialization Artificial Intelligence and Data Science								
130103121	Introduction To Data Science	3	0	0	3	**40**	**60**	**100**
130103122	Introduction To Data Science Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	19	0	14	**26**	**340**	**510**	**850**

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SEMESTER – IV

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130104111	Structural Analysis	3	0	0	3	**40**	**60**	**100**
130104112	Fluid Mechanics	3	0	0	3	**40**	**60**	**100**
130104113	Fluid Mechanics Lab	0	0	2	1	**20**	**30**	**50**
130104114	Concrete technology	3	0	0	3	**40**	**60**	**100**
130104115	Concrete Technology Lab	0	0	2	1	**20**	**30**	**50**
	SEC-II (GIS Lab)	0	0	4	2	**20**	**30**	**50**
	VAC-IV	2	0	0	2	**20**	**30**	**50**
	AECC-IV	2	0	0	2	**20**	**30**	**50**
Program Elective-II Pool (Choose One from the pool)								
130104117	Advanced Surveying	3	0	0	3	**40**	**60**	**100**
130104118	Environment impact assessment							
130104119	Engineered Systems and Sustainability							
130104120	Introduction to AI and Data Analytics for Civil Engineering							
	Total	16	0	8	**20**	**260**	**390**	**650**
Additional Credits For Specialization Artificial Intelligence and Data Science								
130104121	Data analysis using Python	3	0	0	3	**40**	**60**	**100**
130104122	Data analysis using Python Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	19	0	10	**24**	**320**	**480**	**800**

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SEMESTER – V

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130105111	Reinforced Concrete Structures-I	3	1	0	4	**40**	**60**	**100**
130105112	Hydrology	3	0	0	3	**40**	**60**	**100**
130105113	Soil Mechanics	3	0	0	3	**40**	**60**	**100**
130105114	Soil Mechanics Lab	0	0	2	1	**20**	**30**	**50**
130105115	Engineering Geology	3	0	0	3	**40**	**60**	**100**
130105116	SEC-III (BIM Lab)	0	0	4	2	**20**	**30**	**50**
130105117	Industrial Training - I / MOOC Course	0	0	2	1	**20**	**30**	**50**
	Personality Development & Career Building (MCNC)	2*	0	0	-	**-**	**-**	**-**
Program Elective-III Pool (Choose One from the pool)								
130105118	Advanced Structural Analysis	3	0	0	3	**40**	**60**	**100**
130105119	Open channel flow							
130105120	Disaster Control and Management							
130105121	Earth and Environment							
	Total	**15+ 2***	**1**	**8**	**20**	**260**	**390**	**650**
Additional Credits for Specialization Artificial Intelligence and Data Science								
130105122	Introduction to AI and ML	3	0	0	3	**40**	**60**	**100**
130105123	Introduction to AI and ML Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	**18 + 2***	**1**	**10**	**24**	**320**	**480**	**800**

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SEMESTER – VI

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130106111	Design of Steel Structures-I	3	1	0	4	**40**	**60**	**100**
130106112	Water Treatment & Supply Systems	3	0	0	3	**40**	**60**	**100**
130106113	Water Treatment & Supply Systems Lab	0	0	2	1	**20**	**30**	**50**
130106114	Highway Engineering	3	0	0	3	**40**	**60**	**100**
130106115	Highway Engineering Lab	0	0	2	1	**20**	**30**	**50**
130106116	Geo-Technology	3	0	0	3	**40**	**60**	**100**
130106117	SEC-IV (Civil Engineering Design Lab)	0	0	4	2	**20**	**30**	**50**
	Quantitative Aptitude & Logical Reasoning (MCNC)	2*	0	0	-	**-**	**-**	**-**
Program Elective-IV Pool (Choose One from the pool)								
130106118	Reinforced Concrete Structures-II	3	0	0	3	**40**	**60**	**100**
130106119	Construction Safety							
130106120	Energy Efficient Structure							
130106121	Introduction to Smart Cities							
	Total	**15 + 2***	**1**	**8**	**20**	**260**	**390**	**650**
Additional Credits for Specialization Artificial Intelligence and Data Science								
130106122	Data Mining	3	0	0	3	**40**	**60**	**100**
130106123	Data Mining Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	**18 + 2***	**1**	**10**	**24**	**320**	**480**	**800**

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SEMESTER – VII

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130107111	Irrigation Engineering	3	0	0	3	**40**	**60**	**100**
130107112	Estimation & Costing	3	0	0	3	**40**	**60**	**100**
130107113	Construction Project Management	2	0	0	2	**40**	**60**	**100**
130107114	Construction Project Management Lab	0	0	4	2	**20**	**30**	**50**
130107115	Capstone Project	0	0	4	2	**20**	**30**	**50**
130107116	SEC-V (Valuation & Costing Lab)	0	0	4	2	**20**	**30**	**50**
130107117	Industrial Training - II	0	0	2	1	**20**	**30**	**50**
Program Elective-V (Choose One from the pool)								
130107118	Bridge Engineering	3	0	0	3	**40**	**60**	**100**
130107119	Ground water engineering							
130107120	Railways, Tunnel and Airport Engineering							
130107121	Waste water treatment							
	Total	11	0	14	**18**	**240**	**360**	**600**
Additional Credits for Specialization Artificial Intelligence and Data Science								
130107122	Data Visualization	3	0	0	3	**40**	**60**	**100**
130107123	Data Visualization Lab	0	0	2	1	**20**	**30**	**50**
	Total with specialization	**14**	**0**	**16**	**22**	**300**	**450**	**750**

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SEMESTER – VIII

Course Code	Course Title	Credit Distribution (Hours/Week)				Marks Distribution		
		L	T	P	C	IAE	ESE	Total
130108111	Earthquake Engineering	3	0	0	3	**40**	**60**	**100**
130108112	Entrepreneurship & Digital Product Management	0	0	4	2	**20**	**30**	**50**
130108113	SEC-VI (Simulation Lab)	0	0	4	2	**20**	**30**	**50**
130108114	Research Project/ Dissertation	0	0	20	10	**80**	**120**	**200**
Program Elective-VI(Choose One from the pool)								
130108115	Structural Dynamics	3	0	0	3	**40**	**60**	**100**
130108116	Stochastic Hydrology							
130108117	New Age Transit System							
130108118	Urban environmental quality Management							
Total		**6**	**0**	**28**	**20**	**200**	**300**	**500**
Additional Credits for Specialization Artificial Intelligence and Data Science								
	Neural Network and Deep Learning	3	0	0	3	**40**	**60**	**100**
	Neural Network and Deep Learning Lab	0	0	2	1	**20**	**30**	**50**
Total with specialization		**9**	**0**	**30**	**24**	**260**	**390**	**650**

Note – L: Lecture Hour/week, T: Tutorial Hour/week, P: Practical Hour/week, C: Credits, IAE: Internal Assessment Examination, ESE: End Semester Examination, MGE: Multidisciplinary Generic Elective, VAC: Value Added Course, AECC:Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses

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**	**260**	**390**	**650**
SEMESTER – II	14	0	12	**20**	**260**	**390**	**650**
SEMESTER – III	16	0	12	**22**	**280**	**420**	**700**
SEMESTER – IV	16	0	8	**20**	**260**	**390**	**650**
SEMESTER – V	15+2*	1	8	**20**	**260**	**390**	**650**
SEMESTER – VI	15+2*	1	8	**20**	**260**	**390**	**650**
SEMESTER – VII	11	0	14	**18**	**240**	**360**	**600**
SEMESTER – VIII	6	0	28	**20**	**200**	**300**	**500**
Total	**109 + 4***	**2**	**98**	**160**	**2020**	**3030**	**5050**

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

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**	**260**	**390**	**650**
SEMESTER – II	14	0	12	**20**	**260**	**390**	**650**
SEMESTER – III	19	0	14	**26**	**340**	**510**	**850**
SEMESTER – IV	19	0	10	**24**	**320**	**480**	**800**
SEMESTER – V	18+2*	1	10	**24**	**320**	**480**	**800**
SEMESTER – VI	18+2*	1	10	**24**	**320**	**480**	**800**
SEMESTER – VII	14	0	16	**22**	**300**	**450**	**750**
SEMESTER – VIII	9	0	30	**24**	**260**	**390**	**650**
Total	**127 + 4***	**2**	**110**	**184**	**2380**	**3570**	**5950**

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

8. SEMESTER-WISE COURSE DETAILS

SEMESTER - I

Course Code	Course Title
130101111	Engineering Mathematics-I
130101112	Programming for Problem Solving
130101113	Programming for Problem Solving Lab
130101114	Engineering Workshop
130101115	Engineering Workshop Lab
130101116	Design Thinking
	MGE-I
	VAC-I
	AECC-I

FACULTY OF ENGINEERING & TECHNOLOGY	
Name of the Department	Computer Science & Engineering
Name of the Program	Bachelor of Technology
Course Code	130101111
Course Title	**Engineering Mathematics-I**
Academic Year	I
Semester	I
Number of Credits	3
Course Prerequisite	Student having knowledge about Simple Math
Course Synopsis	To provide the students with sufficient knowledge in calculus and matrix algebra, this can be used in their respective fields.

Course Outcomes:

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

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

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

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

Average	**3**	**1.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4**	**4**	**-**	**4**

Course Content:

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

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

Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
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	✓	✓	✓	✓
Assignment / Presentation	✓	✓	✓	✓
Unit test	✓	✓	✓	✓
Mid Semester Examination 1	✓	✓	✓	✓

Mid Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓
Feedback Process	1. Student's Feedback			

References:	**Textbooks:** 1. B. S. Grewal, "Higher Engineering Mathematics", 44/e, Khanna Publishers, 2017. 2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10/e, John Wiley& Sons, 2011.
	Books: 1. N. P. Bali, "Engineering Mathematics", Lakshmi Publications. 2. George B. Thomas, Maurice D. Weir and Joel Hass, "Thomas Calculus", 13/e, Pearson Publishers,2013. 3. H. K. Dass, "Advanced Engineering Mathematics", S. Chand and complany Pvt. Ltd. 4. Michael Greenberg, "Advanced Engineering Mathematics", Pearson, Second Edition.

FACULTY OF ENGINEERING & TECHNOLOGY	
Name of the Department	Computer Science & Engineering
Name of the Program	Bachelor of Technology
Course Code	130101112
Course Title	**Programming for Problem Solving**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Understand various computer components.

Course Outcomes:

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

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

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	-	-	-	-	-	-	1	1	-	1
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	-	1
CO3	-	1	-	1	-	-	-	-	-	-	-	-	1	-	1
CO4	1	2	1	2	2	-	-	-	3	-	1	-	1	-	1
Average	1	1.25	1	1	2	-	-	-	3		1	1	1	2	1

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

Unit	Content and Competency
1	Explain the Operating System [Unix, Linux, Windows]. C2 (Understand), Explain the Programming Environment, and Write & Execute the first program. C2 (Understand), Recall the purpose Digital Computer. C1 (Remember), Recite the concept of an algorithm, their termination and correctness. C1 (Remember), Analyze Algorithms to programs: specification, top-down development and stepwise refinement. C4 (Analyze), Analyze Programming, Use of high level programming language for the systematic development of programs. C4 (Analyze), Design and implementation of correct, efficient and maintainable programs. C5 (Evaluate), Describe number systems and conversion methods. C2 (Understand)
2	Generalize the concept of Standard I/O in “C”. C5 (Evaluate), Explain the concepts of Data Types: Character types, Integer, short, long, unsigned, single and double-precision floating point. C2 (Understand), Define storage classes: automatic, register, static and external. C2 (Understand), Analyze the Operators and Expressions: Using numeric and relational operators, mixed operands and type conversion, Logical operators, and Bit operations. C4 (Analyze)
3	Explain the concepts of Conditional Program Execution: Applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch. C2 (Understand), Recall the purpose and importance of Program Loops and Iteration: Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue. C1 (Remember), Describe Modular Programming: Passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules. C2 (Understand), Outline the purpose and significance of Arrays: Array notation and representation, manipulating array elements, using multidimensional arrays, arrays of unknown or varying size. C1 (Remember), Explain the principles of Structures: usage of

	structures, declaring structures, and assigning of structures. C2 (Understand)
4	Recall the purpose and basic functions of Pointers to Objects using pointers as function arguments. C1 (Remember), Explain the principles of Dynamic memory allocation. C2 (Understand), Generalize the concept of Standard C Preprocessor. C5 (Evaluate), Defining and calling macros. C2 (Understand), Explain Standard C Library: Input/Output: fopen, fread, etc, string handling functions, Math functions : log, sin, alike Other Standard C functions. C2 (Understand)

Learning Strategies and Contact Hours

Learning Strategies	**Contact Hours**
Lecture	20
Practical	
Seminar/Journal Club	1
Small group discussion (SGD)	1
Self-directed learning (SDL) / Tutorial	2
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	2
Revision	2
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 Clinical Examination (OSCE)	University Examination
Objective Structured Practical Examination (OSPE)	Dissertation

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

Mapping of Assessment with COs

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

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

Faculty of Engineering & Technology	
Name of the Department	Computer Science & Engineering
Name of the Program	Bachelor of Technology
Course Code	130101113
Course Title	**Programming for Problem Solving Lab**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Understand various computer components.

Course Outcomes:

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

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

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

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

Average	3.0	1.8	2.3	0.8	1.0	0.5	-	-	-	-	1.3	2.5	3.0	2.0	0.5

Course Content:

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

Content & Competencies

Sr. No.	Title	
1	a) Write a C program to find sum and average of three numbers. C1 (Remember) b) Write a C program to find the sum of individual digits of a given positive integer.C1 (Remember)	
2	a) Write a C program to generate the first n terms of the Fibonacci sequence. C1 (Remember) b) Write a C program to generate prime numbers from 1 to n. C1 (Remember) c) Write a C program to check whether given number is Armstrong Number or not. C1 (Remember)	
3	a) Write a C program to check whether given number is perfect number or not. C1 (Remember) b) Write a C program to check whether given number is strong number or not. C1 (Remember)	
4	a) Write a C program to find the roots of a quadratic equation. C1 (Remember) b) Write a C program to perform arithmetic operations using switch statement. C1 (Remember)	
5	a) Write a C program to find factorial of a given integer using non-recursive function. C1 (Remember) b) Write a C program to find factorial of a given integer using recursive function. C1 (Remember)	
6	a) Write C program to find GCD of two integers by using recursive function. b) Write C program to find GCD of two integers using non-recursive function.	
7	a) Write a C program to find both the largest and smallest number in a list of integers. C1 (Remember) b) Write a C program to Sort the Array in an Ascending Order. C1 (Remember) c) Write a C program to find whether given matrix is symmetric or not. C1 (Remember)	
8	a) Write a C program to perform addition of two matrices. C1 (Remember) b) Write a C program that uses functions to perform multiplication of two	

	Matrices. C1 (Remember)
9	a) Write a C program to use function to insert a sub-string in to given main string from a given position. C1 (Remember) b) Write a C program that uses functions to delete n Characters from a given position in a given string. C1 (Remember)
10	a) Write C program to count the number of lines, words and characters in a given text. C1 (Remember) b) Write a C program to find the sum of integer array elements using pointers. C1 (Remember)
11	a) Write a C program to Calculate Total and Percentage marks of a student using structure. C1 (Remember)
Note:	

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
Multiple Choice Questions (MCQ)	--
Viva-voce	Practical Examination & Viva-voce
Objective Structured Practical Examination (OSPE)	University Examination

Quiz	--
Seminars	--
Problem Based Learning (PBL)	--
Journal Club	--

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
VIVA	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

Feedback Process	1. Student's Feedback Course Exit Survey

Students Feedback is taken through various steps

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

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

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

Faculty of Engineering & Technology	
Name of the Department	Mechanical Engineering
Name of the Program	Bachelor of Technology
Course Code	130101114
Course Title	**Engineering Workshop**
Academic Year	I
Semester	I
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Engineering Workshop 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	Recall the different manufacturing processes used in the industry for fabricating components with various materials.
CO2	Demonstrate the ability to fabricate components manually.
CO3	Analyze dimensional accuracies and tolerances achievable through different manufacturing processes. Interpret electrical signals.
CO4	Understand electrical and electronics circuits fundamentals and design individual 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**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	-	3	1	-	-	-	-	-	1	3	2	1
CO2	3	2	2	-	-	1	-	-	-	-	2	3	3	2	-
CO3	3	2		-	-	-	-	-	-	-	1	3	3	2	-
CO4	3	2	3	3	1	-	-	-	-	-	2	3	3	2	1

Average	3.0	1.8	2.3	3	2	1	-	-	-	-	1.3	2.5	3.0	2.0	1

Course Content:

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

Unit	Content & Competencies
1	Introduction to Manufacturing Processes and their Classification (C1, C2) Recall the different manufacturing processes and their classification. C1 (Remember) Analyze the classification of manufacturing processes. C2 (Understand) Evaluate the significance of manufacturing processes in various industries. C2 (Understand) Overview of Manufacturing Processes C1 (Remember) Identify the main aspects of manufacturing processes. C1 (Remember) Classification of Manufacturing Processes C2 (Understand) Classify manufacturing processes based on their characteristics. C2 (Understand) Importance of Manufacturing Processes in Various Industries C2 (Understand) Assess the significance of manufacturing processes in different industries. C2 (Understand) Additive Manufacturing (C2, C3) Recognize the concept of additive manufacturing. C2 (Understand) Examine the principles and techniques employed in additive manufacturing. C3 (Application) Evaluate the applications and benefits associated with additive manufacturing. C3 (Application) Industrial Safety: Introduction and Types of Accidents (C1, C2) Recall the fundamental concepts of industrial safety. C1 (Remember) Differentiate between various types of accidents. C2 (Understand) Understanding Accidents and Their Types C2 (Understand) Analyze accidents and their categorization. C2 (Understand) Common Causes of Accidents in Industrial Settings C2 (Understand) Identify the frequent reasons behind accidents in industrial environments. C2 (Understand) Common Sources of Accidents and Safety Methods (C2, C3) Identify common sources of accidents in industrial settings. C2 (Understand)

	Implement safety methods and practices to prevent accidents in the workplace. C3 (Application) Conduct risk assessments and apply hazard control measures. C3 (Application) First Aid in Industrial Settings (C2, C3) Recognize the importance of providing first aid in industrial environments. C2 (Understand) Demonstrate knowledge of basic first aid techniques and procedures. C3 (Application) Manage common workplace injuries and emergencies effectively. C3 (Application) Objectives of Layout and Types of Plant Layout (C2, C3) Understand the goals and objectives of layout design. C2 (Understand) Differentiate between various types of plant layout, such as process, product, cellular, and fixed position. C3 (Application) Evaluate the advantages and limitations associated with each type of layout. C3 (Application)
2	Basic Principles of Hot & Cold Working (C1-C3) Recall the basic principles of hot and cold working. C1 (Remember) Understand the differences between hot and cold working processes. C2 (Understand) Analyze the basic principles of hot and cold working. C3 (Application) Hot & Cold Working Processes (C2-C4) Explain the overview of the rolling process. C2 (Understand) Introduce the concept of extrusion. C2 (Understand) Understand the fundamentals of forging. C3 (Application) Provide an introduction to the drawing process. C3 (Application) Apply wire drawing techniques. C4 (Analyze) Explain the overview of the spinning process. C4 (Analyze) Sheet Metal Operations (C2-C4) Demonstrate measuring, layout marking, and precision techniques. C2 (Understand) Apply shearing techniques in sheet metal operations. C3 (Application) Perform punching, blanking, and piercing processes. C3 (Application) Introduce different forming operations. C3 (Application) Apply bending techniques in sheet metal operations. C4 (Analyze) Describe various joining methods for sheet metal. C4 (Analyze) Timber: Advantages, Types, and Defects (C1-C2) Recognize the advantages and characteristics of timber. C1 (Remember) Classify different types of timber. C2 (Understand) Identify common defects in timber and understand their impact. C2 (Understand) Carpentry Tools and Metal Classification C2 (Understand), C3 (Application) Identify essential carpentry tools and explain their uses. C2 (Understand)

	Classify metals based on their properties. C3 (Application) Fitting Tools and Operations (C2-C4) Provide an overview of fitting tools and their applications. C2 (Understand) Explain different fitting operations. C3 (Application) Demonstrate techniques for precise fitting. C4 (Analyze) Glass Cutting C2 (Understand), C3 (Application) Introduce various glass cutting techniques. C2 (Understand) Describe the tools and methods used for glass cutting. C3 (Application)
3	Introduction to Casting Processes (C1-C3) Provide an overview of casting processes. C1 (Remember) Understand patterns and their types. C2 (Understand) Explain pattern allowances for casting. C2 (Understand) Introduce sand casting. C2 (Understand) Understand sand properties and constituents. C3 (Application) Explain the preparation of sand molds. C3 (Application) Gating System and Melting of Metal C2 (Understand), C3 (Application) Explain the basics of the gating system in casting. C2 (Understand) Discuss melting techniques for metal casting. C3 (Application) Provide an overview of the cupola furnace. C3 (Application) Casting Defects and Remedies (C2-C4) Identify common casting defects and their causes. C2 (Understand) Discuss remedies for casting defects. C3 (Application) Explain quality control in casting processes. C4 (Analyze) Plastic Molding Techniques C2 (Understand), C3 (Application) Introduce plastic molding techniques. C2 (Understand) Discuss different plastic molding processes. C3 (Application) Metalworking Machines: Lathe, CNC, Shaper, and Planner (C2-C4) Provide an overview of the lathe machine. C2 (Understand) Explain lathe operations and techniques. C3 (Application) Introduce CNC machining. C3 (Application) Discuss the basics of the shaper and planner machines. C4 (Analyze) Introduction to Welding (C1-C3) Explain the basics of welding processes. C1 (Remember) Classify different welding processes. C2 (Understand) Provide an overview of welding equipment and safety measures. C3 (Application) Welding Defects, Remedies, Soldering, and Brazing (C2-C4) Identify common welding defects and their causes. C2 (Understand) Discuss remedies for welding defects. C3 (Application) Introduce soldering and brazing techniques. C4 (Analyze)
4	Electrical Fundamentals (C1-C3) Understand the measurement of voltage, current, frequency, and phase difference. C2 (Understand) Perform power and power factor calculations. C2 (Understand) Explain single-phase and three-phase supply systems. C3 (Application)

	Wiring and Circuit Control C2 (Understand), C3 (Application) Demonstrate the wiring of wire fans and tube lights. C2 (Understand) Implement two-way control circuit wiring. C3 (Application) Install MCBs and ELCBs for load circuits. C3 (Application) Electronics Fundamentals (C1-C3) Introduce basic electronic components. C2 (Understand) Conduct testing of resistors, inductors, capacitors, and diodes. C3 (Application) Understand the principles of BJTs (Bipolar Junction Transistors). C3 (Application) Testing and Measurement Instruments C2 (Understand), C3 (Application) Explain the operation and usage of power supplies. C2 (Understand) Understand the principles and application of function generators. C3 (Application) Explore the fundamentals of oscilloscope and perform measurements. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	10
Practical	--
Seminar/Journal Club	1
Small group discussion (SGD)	1
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	--
Revision	1
Others If any:	--
Total Number of Contact Hours	15

Assessment Methods:

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

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

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Assignment / Presentation	✓	✓	✓	✓
Mid-Semester Examination 1	✓	✓	✓	✓
Mid-Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

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

Students Feedback is taken through various steps

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

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

Faculty of Engineering & Technology	
Name of the Department	Mechanical Engineering
Name of the Program	Bachelor of Technology
Course Code	130101115
Course Title	**Engineering Workshop Lab**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Engineering Workshop 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	Recall the different manufacturing processes commonly used in the industry to fabricate components with various materials.
CO2	Demonstrate hands-on fabrication of components.
CO3	Analyze dimensional accuracies, tolerances, and electrical signals associated with different manufacturing processes.
CO4	Understand the basics of electrical and electronics circuits and design custom 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**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	-	3	1	-	-	-	-	-	1	3	2	1
CO2	3	2	2	-	-	1	-	-	-	-	2	3	3	2	-
CO3	3	2		-	-	-	-	-	-	-	1	3	3	2	-

CO4	3	2	3	3	1	-	-	-	-	-	2	3	3	2	1
Average	3.0	1.8	2.3	0.8	1.0	0.5	-	-	-	-	1.3	2.5	3.0	2.0	0.5

Course Content:

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

Sr. No.	Content & Competencies
1	To study different types of measuring tools used in metrology and determine the least counts of vernier callipers, micrometers and vernier height gauges. (C1-C4)
2	To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off. (C1-C6)
3	To study different types of fitting tools and marking tools used in fitting practice. (C1-C3)
4	To prepare a layout on a metal sheet by making and prepare rectangular tray pipe-shaped components e.g., funnel. (C1-C6)
5	To prepare joints for welding suitable for butt welding and lap welding. (C1, C2, C3, C6)
6	To study various types of carpentry tools and prepare simple types of at least two wooden joints. (C1-C4, C6)
7	Measurement of voltage and current by multimeter and performing testing of various components. (C1-C4)
8	To study cathode ray oscilloscope and perform measurements for a different signal. (C1-C4)
9	To study 1) Safety precaution. 2) Electrical safety devices & protection like MCB, ELCB and Fuse. (C1-C3)
10	To prepare of wiring diagram 1) Ceiling fan and Tube light 2) Two-way control switch. (C1-C3)
11	To study the breadboard and PCB connection for Electronics circuit (C1-C3, C6)
12	To study soldering and de-soldering techniques for Electronics circuits. (C1-C3)
13	To study different case studies using Arduino. (C1-C4)
Note:	1. At least ten experiments/ jobs are to be performed/ prepared by students in the semester. 2. At least 8 experiments/ jobs should be performed/prepared from the above list, the remaining two may either be performed/prepared from the

	above list or designed and set as per the scope of the syllabus of the Engineering Workshop.

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	--
Viva-voce	Practical Examination & Viva-voce
Objective Structured Practical Examination (OSPE)	University Examination
Quiz	--
Seminars	--
Problem Based Learning (PBL)	--
Journal Club	--

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4

VIVA	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

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

Students Feedback is taken through various steps

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

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

References:	**Books**
	i) Workshop Technology Vol. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi., Vol-I: ISBN-10: 8185099146 ,Vol-II : ISBN :9788185099156. ii) Workshop Technology (Manufacturing Process) –S K Garg, Laxmi Publications; Fourth Edition (2018), ISBN-10: 8131806979. iii) Principles of Manufacturing Materials and Processes - Campbell, J.S. - McGraw- Hill, NewEdition, ISBN-10: 0070992525

Faculty of Engineering & Technology	
Name of the Department	Mechanical Engineering
Name of the Program	Bachelor of Technology
Course Code	130101116
Course Title	**Design Thinking**
Academic Year	I
Semester	I
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Design Thinking and Innovation is a practical course that introduces students to the principles and methodologies of design thinking, a human-centred approach to problem-solving. This course explores the process of identifying and solving complex problems, fostering creativity, and promoting innovation. Through hands-on exercises, projects, and case studies, students will deeply understand design thinking principles and gain practical skills to apply them in various contexts.

Course Outcomes:

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

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

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	-	3	3	-	-	-	-	3	1	3	2	`1
CO2	2	3	2	-	-	2	-	-	-	-	2	3	3	2	2

CO3	2	3	2	-	-	3	-	-	-	-	1	3	3	2	2
CO4	2	3	3	3	3	2	-	-	-	-	2	3	3	2	1
Average	2	3	2.5	0.8	1.5	2.5	-	-	-	-	2	2.5	3.0	2.0	1.5

Course Content:

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

Sr. No.	Content & Competencies
1	Introduction to Design Thinking (Week 1-2) Understanding the concept of Design Thinking and its significance C1 (Remember) Exploring the role of Design Thinking in problem-solving and innovation C1 (Remember) Different Stages of Design Thinking C2 (Understand) Empathize: Understanding the importance of empathy in the design process C2 (Understand) Define: Defining the problem statement and framing the design challenge C2 (Understand) Ideate: Generating creative ideas and exploring multiple solutions C2 (Understand) Prototype: Building tangible representations of ideas C2 (Understand) Test: Iteratively testing and refining prototypes to gather feedback C2 (Understand) Problems Solved using Design Thinking C2 (Understand), C3 (Application) Identifying the types of problems that can benefit from Design Thinking C2 (Understand) Analyzing how Design Thinking can be applied across various industries and disciplines C3 (Application) Case Studies and Videos C3 (Application), C4 (Analyze) Reviewing case studies illustrating the application of Design Thinking in real-world scenarios C3 (Application) Watching videos showcasing Design Thinking processes and outcomes C3 (Application)
2	Empathize and Define(Week 3-4) Techniques to Understand and Empathize with Users' Needs C2 (Understand) Conducting user interviews and observations C2 (Understand) Applying active listening and empathy techniques C2 (Understand) Engaging in participatory design activities C2 (Understand) Analyzing user feedback and insights C2 (Understand)

	Key Points for Defining the Problem Statement C3 (Application) Understanding the importance of a well-defined problem statement C3 (Application) Identifying the key elements of a problem statement C3 (Application) Focusing on user needs and desired outcomes C3 (Application) Formulating clear and concise problem statements C3 (Application) Creating User Personas and Customer Journey Maps C3 (Application) Developing user personas based on research and insights C3 (Application) Mapping the customer journey to understand the user experience C3 (Application) Analyzing pain points and opportunities for improvement C3 (Application) Incorporating personas and journey maps into the design process C3 (Application) Hands-on Activities and Case Studies C4 (Analyze) Engaging in hands-on activities to apply user-cantered design techniques C4 (Analyze) Analysing and discussing case studies illustrating successful user-centred design C4 (Analyze) Collaborating on design challenges and problem-solving exercises C4 (Analyze) Reflecting on lessons learned and applying insights to real-world scenarios C4 (Analyze)
3	Ideation (Week 5-6) Methods to Brainstorm Ideas and Approaches C2 (Understand) Understanding the importance of brainstorming in the ideation process C2 (Understand) Exploring different brainstorming techniques, such as free association, mind mapping, and SCAMPER C2 (Understand) Stimulating creativity through techniques like analogies, random word associations, and reverse thinking C2 (Understand) Fostering a collaborative and inclusive brainstorming environment C2 (Understand) Using Criteria to Select the Best Ideas and Approaches C3 (Application) Defining evaluation criteria based on project goals, user needs, and feasibility C3 (Application) Applying decision matrices or scoring systems to compare and prioritize ideas C3 (Application) Conducting effective group discussions and consensus-building to select the best ideas C3 (Application) Considering the potential impact, viability, and alignment with project constraints C3 (Application) Hands-on Activities and Creativity Techniques C3 (Application) Engaging in hands-on activities, such as design challenges and ideation exercises C3 (Application) Applying creativity techniques like SCAMPER, mind mapping, random stimuli, and role reversal C3 (Application)

	Stimulating divergent thinking through techniques like brainstorming variations and quantity-focused exercises C3 (Application) Encouraging experimentation and risk-taking to foster creative thinking C3 (Application) Practice Sessions and Case Study Discussions C4 (Analyze) Participating in practice sessions to apply brainstorming and idea selection techniques C4 (Analyze) Analyzing and discussing case studies showcasing successful ideation and innovation C4 (Analyze) Reflecting on lessons learned and applying insights to real-world challenges C4 (Analyze) Collaborating with peers in group activities to share ideas and feedback C4 (Analyze)
4	Prototype & Test (Week 7-10) Designing a Prototype C2 (Understand) Understanding the purpose and benefits of prototyping in the design process C2 (Understand) Selecting appropriate prototyping methods based on project goals and constraints C2 (Understand) Creating low-fidelity prototypes using paper, cardboard, or digital tools C2 (Understand) Developing high-fidelity prototypes using software, 3D printing, or other relevant tools C2 (Understand) Approaches to Testing and Validating the Prototype C3 (Application) Defining objectives and research questions for prototype testing C3 (Application) Conducting user testing sessions to gather feedback and insights C3 (Application) Employing methods such as usability testing, A/B testing, and surveys C3 (Application) Iteratively refining and improving the prototype based on user feedback C3 (Application) Hands-on Activities and Design Exercises C3 (Application) Engaging in hands-on activities to create prototypes and iterate designs C3 (Application) Participating in design exercises that simulate real-world challenges C3 (Application) Collaborating with peers to gather feedback and iterate on designs C3 (Application) Applying design principles and user-cantered approaches in prototype development C3 (Application) Class Presentation of Prototypes C4 (Analyze) Preparing a comprehensive presentation of the prototype, design process, and user feedback C4 (Analyze) Showcasing the functionality, usability, and value of the prototype C4 (Analyze)

	Engaging in class discussions and receiving feedback from peers and instructors C4 (Analyze) Reflecting on the design decisions and lessons learned throughout the prototyping process C4 (Analyze)
5	Implementation Challenges (Week 11-12) Overcoming Implementation Challenges C2 (Understand) Identifying common challenges and barriers when implementing design thinking C2 (Understand) Developing strategies to overcome resistance and skepticism C2 (Understand) Creating a supportive organizational culture for design thinking adoption C2 (Understand) Addressing resource constraints and time limitations C2 (Understand) Collaborative Approaches to Implement Design Thinking C3 (Application) Promoting cross-functional collaboration and teamwork C3 (Application) Establishing multidisciplinary design teams for diverse perspectives C3 (Application) Adopting co-creation and participatory approaches C3 (Application) Encouraging open communication and knowledge sharing C3 (Application) Evaluation Techniques C3 (Application) Defining evaluation criteria and metrics for design thinking initiatives C3 (Application) Conducting qualitative and quantitative assessments of design thinking outcomes C3 (Application) Using feedback loops and iterative improvement cycles C3 (Application) Incorporating user feedback and stakeholder perspectives in the evaluation process C3 (Application) Case Study Discussion C4 (Analyze) Analyzing and discussing case studies showcasing successful design thinking implementation C4 (Analyze) Extracting lessons learned and best practices from real-world examples C4 (Analyze) Applying insights from case studies to identify opportunities and strategies for implementation C4 (Analyze) Engaging in group discussions to reflect on challenges and potential solutions C4 (Analyze)
6	Innovation in Design Thinking (Week 13-14) Identifying Innovation in Design Thinking C2 (Understand) Understanding the role of innovation in design thinking processes C2 (Understand) Identifying innovative solutions and approaches in real-world design cases C2 (Understand) Analyzing design thinking projects for their innovative aspects C2 (Understand) Recognizing the impact of innovation on user experiences and business outcomes C2 (Understand) Staying Curious and Seeking New Insights and Ideas C3 (Application)

	Cultivating a mindset of curiosity and openness to new perspectives C3 (Application) Actively seeking diverse sources of inspiration and knowledge C3 (Application) Applying techniques such as active listening, asking questions, and conducting research C3 (Application) Embracing a continuous learning approach to stay updated on emerging trends C3 (Application) Techniques to Enhance Creativity and Overcome Obstacles C3 (Application) Exploring techniques for idea generation, such as brainstorming, mind mapping, and SCAMPER C3 (Application) Overcoming creative blocks and fostering a positive mindset C3 (Application) Embracing experimentation and risk-taking to explore unconventional ideas C3 (Application) Applying problem-solving frameworks to address obstacles and challenges C3 (Application) Assignment Forum Discussion C4 (Analyze) Engaging in assignment forums to discuss innovation-related topics C4 (Analyze) Sharing perspectives, insights, and experiences with fellow students C4 (Analyze) Providing feedback and constructive criticism to peers C4 (Analyze) Reflecting on and refining ideas through discussions and collaborative learning C4 (Analyze)
7	Final Project Presentation (Week 15) Presentation of Final Project C4 (Analyze) Preparing a comprehensive presentation of the final design thinking project C4 (Analyze) Demonstrating the design process, key insights, and solutions C4 (Analyze) Showcasing the impact and value of the project for users and stakeholders C4 (Analyze) Engaging the audience through effective storytelling and visual aids C4 (Analyze) Collecting Feedback and Evaluation Techniques C4 (Analyze) Implementing techniques to collect constructive feedback on the project C4 (Analyze) Conducting peer reviews and evaluations to gather diverse perspectives C4 (Analyze) Incorporating feedback to refine and improve the project C4 (Analyze) Using evaluation criteria to assess the effectiveness of the project C4 (Analyze) Final Course Evaluation C3 (Application) Reflecting on the learning outcomes and achievements of the entire course C3 (Application) Assessing personal growth and development in design thinking skills C3 (Application) Identifying strengths, areas for improvement, and future learning goals C3

	(Application) Providing an overall evaluation of the course structure, content, and delivery C3 (Application) Final Course Feedback Form C2 (Understand) Engaging in a structured feedback process to provide input on the course C2 (Understand) Sharing suggestions, comments, and recommendations for improvement C2 (Understand) Offering insights on the effectiveness of the course materials and learning activities C2 (Understand) Contributing to the continuous improvement of the design thinking program C2 (Understand)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
Multiple Choice Questions (MCQ)	--
Viva-voce	Practical Examination & Viva-voce
Objective Structured Practical Examination (OSPE)	University Examination
Quiz	--
Seminars	--

Problem Based Learning (PBL)	--
Journal Club	--

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
VIVA	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

Feedback Process	2. Student's Feedback Course Exit Survey

Students Feedback is taken through various steps

3. Regular feedback through the Mentor Mentee system.
4. Feedback between the semester through google forms.

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

References:	**Books**
	i) Innovation By Design by Chakravarthy, Battula Kalyana, and Janaki Krishnamoorthy, Springer India, 2013, ISBN 978-81-322-0901-0 ii) Innovation by Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions by Thomas Lockwood, New Page Books, US; 1st edition (28 November 2017), ISBN: 1632651165. iii) Innovation by Design by Gerard Gaynor, Amacom, A Division of American Management Associ135 West 50th Street New York, NY, United States, ISBN:978-0-8144-0696-0

SEMESTER - II

Course Code	Course Title
130102111	Engineering Mathematics-II
130102112	Basics of Electrical & Electronics Engineering
130102113	Basics of Electrical & Electronics Engineering Lab
130102114	Engineering Graphics and Design
130102115	Engineering Graphics and Design Lab
130102116	New Age Skills
	MGE-II
	VAC-II
	AECC-II

FACULTY OF ENGINEERING & TECHNOLOGY	
Name of the Department	Computer Science & Engineering
Name of the Program	Bachelor of Technology
Course Code	130102111
Course Title	**Engineering Mathematics-II**
Academic Year	I
Semester	II
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Create and analyze mathematical models using first and higher order differential equations to solve application problems such as electrical circuits, orthogonal trajectories and Newton‟s law of cooling and also familiarize the student in various topics in numerical analysis such as interpolation, numerical differentiation, integration and direct methods for solving linear system of equations.

Course Outcomes:

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

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

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

COs	PO 1	PO2	P O3	P O4	P O5	P O6	P O7	P O8	PO 9	PO 10	PO 11	PO1 2	PSO 1	PSO 2	PS O3
CO1	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**

CO2	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**
CO3	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**
CO4	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
Average	**3**	**1.75**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**0.75**	**1**

Course Content:

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

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

Teaching Learning Strategies and Contact Hours

Learning Strategies	**Contact Hours**

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

Assessment Methods:

Formative	Summative
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	✓	✓	✓	✓
Assignment / Presentation	✓	✓	✓	✓
Unit test	✓	✓	✓	✓
Mid Semester Examination 1	✓	✓	✓	✓
Mid Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓
Feedback Process	Student's Feedback			

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

FACULTY OF ENGINEERING & TECHNOLOGY	
Name of the Department	Computer Science & Engineering
Name of the Program	Bachelor of Technology
Course Code	130102112
Course Title	**Basics of Electrical and Electronics Engineering**
Academic Year	I
Semester	II
Number of Credits	2
Course Prerequisite	Basic aspects of electrical engineering.
Course Synopsis	This course gives idea about basic circuit solution methods, introduction to electrical machines and basics of domestic electrical installations

Course Outcomes:

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

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

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

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	1	-	-	1	-	-	-	-	-	-	2	-	-	
CO2	3	1	-	-	1	-	-	-	-	-	-	2	-	1	
CO3	3	1	-	-	1	-	-	-	-	-	-	2	-	-	
CO4	1	-	1	-	-	-	-	-	-	-	-	2	-	-	

Average	**1.75**	**-**	**0.25**	**-**	**0.75**	**0.75**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**0.25**	

Course Content:

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

Unit	Content	Competency
1	Explain Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis. C2 (Understand), Define Circuit parameters, energy storage aspects. C1 (Remember), Implement Superposition Theorem and Thevenin's Theorem, Implement Norton's, Reciprocity, Maximum Power Transfer Theorem, and Describe Millman's Theorem. C2 (Understand), Define Star-Delta Transformation. C1 (Remember), Application of theorem to the Analysis of D.C. circuits. C3 (Application)	
2	Explain A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant. C2 (Understand), Describe Phasor representation.C2 (Understand), Implement Response of RL, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits. C6 (Create), Explain Q-factor. C2 (Understand), Explain Bandwidth. C2 (Understand), Describe Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), C2 (Understand), Describe Cathode ray tube (CRT) & its component. C2 (Understand)	
3	Explain Semiconductor Physics: Basic concepts.C2 (Understand), Differentiate Intrinsic and extrinsic semiconductors.C2 (Understand), Differentiate diffusion and drift currents. C2 (Understand), Implement P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit. C6 (Create), Describe Diode Current Equation. C2 (Understand), Describe Diode Resistance. C2 (Understand), Demonstrate Transition and Diffusion Capacitance. C3 (Application), Define Effect of Temperature. C1 (Remember), Define Carrier Life Time. C1 (Remember), Demonstrate Continuity Equation. C3 (Application), Explain Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes. C2 (Understand)	
4	Explain Digital Electronics: Boolean algebra. C2 (Understand), Implement Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates. C6 (Create), Define Bipolar junction	

	transistor. C1 (Remember), Describe transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents. C2 (Understand), Application of BJT: CB, CE configurations. C3 (Application), Introduction to FETs and MOSFETs. C1 (Remember)

Teaching Learning Strategies and Contact Hours

Learning Strategies	**Contact Hours**
Lecture	20
Practical	
Seminar/Journal Club	1
Small group discussion (SGD)	1
Self-directed learning (SDL) / Tutorial	1
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	1
Revision	4
Others If any:	
Total Number of Contact Hours	30

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	✓	✓	✓	✓
Assignment / Presentation	✓	✓	✓	✓
Unit test	✓	✓	✓	✓

Mid Semester Examination 1	✓	✓	✓	✓
Mid Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓
Feedback Process	1. Student's Feedback			
References:	**Textbooks:** 1. Fundamentals of Electrical Circuits by Charles k.Alexander, Mattew N.O. Saidiku, Tata McGraw Hill company. 2. V.N. Mittle "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990. 3. Electrical Technology by Surinder Pal Bali, Pearson Publications. 4. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006. 5. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.			
	References: 1. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition 2. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics, and Computer Engineering", Tata McGraw Hill, Second Edition, (2006). 3. Industrial Electronics by G.K. Mittal, PHI 4. Nagsarkar T K and Sukhija MS, "Basics of Electrical Engineering", Oxford Press (2005).			

Faculty of Engineering & Technology	
Name of the Department	Computer Science & Engineering
Name of the Program	Bachelor of Technology
Course Code	130102113
Course Title	**Basics of Electrical and Electronics Engineering Lab**
Academic Year	I
Semester	II
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	To design electrical systems. To analyze a given network by applying various network theorems. To know the response of electrical circuits for different excitations. To study various electrical measuring instruments and transducers. To summarize the performance characteristics of electrical machines

Course Outcomes:

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

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

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	-	3	-	-	-	-	2	-	-	3	2	1
CO2	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
CO3	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1

CO4	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
Average	2	1	1	1	3	-	-	-	-	2	-	-	3.0	2.0	1

Course Content:

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

Content & Competencies

Unit	Title
1	Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits. C1 (Remember)
2	Verification of KVL and KCL. C6 (Create)
3	Verification of Thevenin's and Norton's theorems. C6 (Create)
4	Verification of superposition theorem. C6 (Create)
5	Verification of maximum power transfer theorem. C6 (Create)
6	Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits. C6 (Create)
7	Verification of relation between phase and line quantities in a 3-phase balanced star and delta connected systems. C6 (Create)
8	Measurement of Active and Reactive Power in a balanced Three-phase circuit. C6 (Create)
9	Torque-Speed Characteristics of a Separately/Self Excited DC Shunt/Compound Motor. C1 (Remember)
10	Load test on single phase transformer. C1 (Remember)
11	Demonstration of measurement of electrical quantities in DC and AC systems. C6 (Create)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--

Practical	30
Seminar/Journal Club	--
Small group discussion (SGD)	20
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	10
Case/Project Based Learning (CBL)	--
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

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

Mapping of Assessment with COs

<table>
<tr><th colspan="2">Nature of Assessment</th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th></tr>
<tr><td colspan="2">VIVA</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Practical Log Book/ Record Book</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">University Examination</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Feedback Process</td><td colspan="4">1. Student’s Feedback
2. Course Exit Survey</td></tr>
<tr><td>References:</td><td colspan="5">Electrical and electronics engineering, person publication 2017</td></tr>
</table>

Faculty of Engineering & Technology	
Name of the Department	Mechanical Engineering
Name of the Program	Bachelor of Technology
Course Code	130102114
Course Title	**Engineering Graphics and Design**
Academic Year	I
Semester	II
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Engineering Graphics and Design is considered the language of engineers. This course is introduced to provide ide basic understanding of the importance of designing aspects in engineering applications. The topics are covered in a sequence and start from the basic concepts of introduction to computer-aided design and then designing of planes and solids. Towards the end of the course, it is expected that students would be matured to visualize the engineering components from any drawing sheet, followed by the projection techniques. A number of chosen problems will be solved to illustrate the concepts clearly.

Course Outcomes:

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

CO1	Understand the utilization of drawing instruments and the process of dimensioning given drawings.
CO2	Acquire skills in visualization and become proficient in employing projection methods.
CO3	Demonstrate the ability to create various views by employing line, plane, and solid projections.
CO4	Utilize edges, vertices, and curves to construct accurate and detailed drawings

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	0	3	-	-	-	-	2	-	-	3	2	1
CO2	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1

CO3	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
CO4	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
Average	2	0.75	1	0.75	3	-	-	-	-	2	-	-	3.0	2.0	1

Course Content:

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

Unit	Content & Competencies
1	Importance of Engineering Graphics and Drawing C1 (Remember) Understand the significance of engineering graphics and drawing in engineering disciplines. C1 (Remember) Explore the applications and benefits of engineering drawings. C1 (Remember) Introduction to Drawing Instruments (C1-C2) Provide an overview of essential drawing instruments. C1 (Remember) Familiarize with drawing tools and their functions. C2 (Understand) Types of Lines (C1-C2) Differentiate between various types of lines used in engineering drawing. C1 (Remember) Understand line conventions and their significance. C2 (Understand) Dimensioning and Lettering C2 (Understand), C3 (Application) Explain the principles and practices of dimensioning in engineering drawings. C2 (Understand) Demonstrate techniques for clear and accurate lettering. C3 (Application) Types of Projections C2 (Understand), C3 (Application) Introduce different types of projections, including orthographic, isometric, and perspective. C2 (Understand) Understand the purpose and applications of each projection type. C3 (Application) Theory of Orthographic Projections C3 (Application) Explain the principles and fundamentals of orthographic projections. C3 (Application) Explore the relationship between object and image in orthographic projection. C3 (Application) First Angle and Third Angle Projections C3 (Application) Understand the differences between first angle and third angle projections. C3 (Application) Explain the application and usage of each projection method. C3 (Application) Projection of Points C3 (Application) Demonstrate techniques for projecting points in orthographic drawings. C3 (Application)

	Understand how points are represented in different views. C3 (Application)
2	Projection of Lines (C2-C4) Understand lines that are parallel to one or both planes. C2 (Understand) Determine the projection of lines that are contained by one or both planes. C3 (Application) Project lines that are perpendicular to a plane. C3 (Application) Handle lines that are inclined to one plane and parallel to the other. C4 (Analyze) Project lines that are inclined to both planes. C4 (Analyze) Determine the true length of a line and its inclinations to the reference planes. C4 (Analyze) Identify the traces of a line. C3 (Application) Introduction to Types of Planes C1 (Remember) Provide an overview of the different types of planes used in engineering drawing. C1 (Remember) Projection of Planes by Change of Position Method (C2-C4) Project a plane that is perpendicular to another plane. C2 (Understand) Project a plane that has an axis parallel to both planes. C3 (Application) Project a plane that has an axis parallel to one plane and inclined to the other plane. C4 (Analyze)
3	Types of Solids C1 (Remember) Provide an overview of different types of solids in solid geometry. C1 (Remember) Polyhedrons and Solids of Revolution C2 (Understand) Understand polyhedrons and their properties. C2 (Understand) Introduce solids of revolution. C2 (Understand) Projection of Solids (C2-C4) Project solids with axes perpendicular to a plane. C3 (Application) Project solids with axes parallel to both planes. C4 (Analyze) Project solids with axes parallel to one plane and inclined to the other plane. C4 (Analyze) Surface Development of Simple Solids C3 (Application), C4 (Analyze) Develop the surface of cubes. C3 (Application) Develop the surface of cylinders. C4 (Analyze) Develop the surface of prisms. C4 (Analyze) Develop the surface of pyramids. C4 (Analyze) Develop the surface of other simple solids. C4 (Analyze)
4	Principle of Projection C2 (Understand) Understand the principle of projection in engineering graphics. C2 (Understand) Explore the basics of how objects are projected onto planes. C2 (Understand) Principal Planes of Projection C2 (Understand), C3 (Application) Introduce the principal planes of projection. C2 (Understand) Understand the relationship between the principal planes. C2 (Understand) Apply techniques for selecting the appropriate views from the principal planes.

	C3 (Application) Projections from Pictorial Views C3 (Application) Perform projections from the front view using first angle projection. C3 (Application) Perform projections from the top view using first angle projection. C3 (Application) Perform projections from the side view using first angle projection. C3 (Application) Perform projections from the front view using third angle projection. C3 (Application) Perform projections from the top view using third angle projection. C3 (Application) Perform projections from the side view using third angle projection. C3 (Application) Full Sectional View C3 (Application) Create a full sectional view of an object. C3 (Application) Understand the purpose and applications of sectional views. C3 (Application) Isometric Scale and Projection C3 (Application), C4 (Analyze) Introduce the isometric scale. C3 (Application) Convert orthographic views into an isometric projection. C4 (Analyze) Create an isometric view or drawing. C4 (Analyze)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	10
Practical	--
Seminar/Journal Club	1
Small group discussion (SGD)	1
Self-directed learning (SDL) / Tutorial	--
Problem Based Learning (PBL)	2
Case/Project Based Learning (CBL)	--
Revision	1
Others If any:	--
Total Number of Contact Hours	15

Assessment Methods:

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

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
Assignment / Presentation	✓	✓	✓	✓
Mid-Semester Examination 1	✓	✓	✓	✓
Mid-Semester Examination 2	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

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

Students Feedback is taken through various steps

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

References:	**Books**

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

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University
NAAC A+

Faculty of Engineering & Technology	
Name of the Department	Mechanical Engineering
Name of the Program	Bachelor of Technology
Course Code	130102115
Course Title	**Engineering Graphics and Design Lab**
Academic Year	I
Semester	II
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Engineering Graphics and Design is considered the language of engineers. This course is introduced to provide ide basic understanding of the importance of designing aspects in engineering applications. The topics are covered in a sequence and start from the basic concepts of introduction to computer-aided design and then designing of planes and solids. Towards the end of the course, it is expected that students would be matured to visualize the engineering components from any drawing sheet, followed by the projection techniques. A number of chosen problems will be solved to illustrate the concepts clearly.

Course Outcomes:

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

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

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	-	3	-	-	-	-	2	-	-	3	2	1
CO2	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1

CO3	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
CO4	2	1	1	1	3	-	-	-	-	2	-	-	3	2	1
Average	2	1	1	1	3	-	-	-	-	2	-	-	3.0	2.0	1

Course Content:

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

Unit	Content & Competencies
1	Different types of lines with illustration and application (C1-C3)
2	Use of Drawing instruments and understand the design sheet layout with dimensioning and lettering. (C1-C4)
3	Applications of drawing commands in AutoCAD. (C1-C4)
4	Projection of points in all four quadrants. (C1-C3)
5	Projection of straight lines parallel, perpendicular, inclined to projection planes and traces of lines. (C1-C3)
6	Projection of plane in perpendicular and inclined positions. (C1-C3)
7	Projection of cones and solid cylinders with axes parallel, perpendicular and inclined to both the reference planes. (C1-C3)
8	Projection of prisms and pyramids with axes parallel, perpendicular, and inclined to both the reference planes. (C1-C3)
9	Orthographic projection of simple machine elements and engineering drawings. (C1-C4)
10	Isometric projection of simple machine elements and engineering drawings. (C1-C4)
11	Sectional views of simple machine elements and engineering drawings. (C1-C4)
Note:	1. At least ten jobs are to be performed/ prepared by students in the semester, either using AutoCAD software or on Drawing sheets using drawing instruments. 2. At least 8 experiments/ jobs should be performed/prepared from the

	above list, the remaining two may either be performed/prepared from the above list or designed and set as per the scope of the syllabus of the Engineering Graphics and Design.

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

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

	(OSPE)

Mapping of Assessment with COs

Nature of Assessment	**CO1**	**CO2**	**CO3**	**CO4**
VIVA	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

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

Students Feedback is taken through various steps

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

References:	**Books**
	1. Bhatt, N. D. (2019). Engineering Drawing: Plane and Solid Geometry: [in First Angle Projection Method]. India: Charotar Publishing House Pvt. Limited. ISBN: 9789380358963, 9380358962. 2. Dhananjay A. Jolhe (2008), "Engineering Drawing", Tata McGraw Hill Publishers. ISBN: 9780070648371, 0070648379. 3. JOHN, K. C. (2009). Engineering Graphics for Degree. India: PHI Learning, ISBN: 9788120337886, 8120337883.

Name of the Department	Computer Science & Engineering
Name of the Program	Bachelor of Technology
Course Code	130102116
Course Title	**New Age Skill Lab**
Academic Year	I
Semester	II
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Knowledge of MS Word, MS Excel, MS PowerPoint, and MS Access.

Course Outcomes:

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

CO1	Understand the concept of MS Word.
CO2	Understand the concept of MS Excel.
CO3	Understand the concept of MS PowerPoint.
CO4	Understand the concept of MS Access.

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

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	0	3	-	-	-	-	2	1	1	3	2	1
CO2	2	1	1	1	3	-	-	-	-	2	1	1	3	2	1
CO3	2	1	1	1	3	-	-	-	-	2	1	1	3	2	1
CO4	2	1	1	1	3	-	-	-	-	2	1	1	3	2	1
Average	2	1	1	0.75	3	-	-	-	-	2	1	1	3.0	2.0	1

Course Content:

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

Content & Competencies		
Unit	**Content**	
1	Create a news-paper document with at least 200 words using MS Word, C5 (Evaluate) a. Use margins as, top:1.5, bottom:2, left:2, right:1 inches. b. Use heading "Gandhi Jayanti", font size: 16, font color: red, font face: Arial Black. c. With first letter "dropped" (use drop cap option) of the first paragraph containing a picture at the right side d. Use three columns from the second paragraph onwards till the half of the page. e. Then use heading "Computer basics"	
2	Create a Mathematical question paper using MS Word, at least five equations C5 (Evaluate) a. With fractions, exponents, summation function b. With at least one m*n matrix c. Basic mathematical and geometric operators. d. Use proper text formatting, page color and page border.	
3	Create a flowchart using MS Word, C5 (Evaluate) a. Proper shapes like ellipse, arrows, rectangle, and parallelogram. b. Use grouping to group all the parts of the flowchart into one single object	
4	Create a table using table menu with word, C5 (Evaluate) a. At least 5 columns and 10 rows. b. Merge the first row into one cell. c. Merge the second row into one cell, then split the second row into three cells	
5	Create a table using MS excel "Student result" with following conditions. a. The heading must contain, Sl. No., Name, Mark1, Mark2, Mark3, Total, average and result with manual entry. C5 (Evaluate) b. Use formulas for total and average. c. Find the name of the students who has secured the highest and lowest marks. d. Round the average to the nearest highest integer and lowest integer (use ceiling and floor function respectively).	
6	Do as directed using MS excel C5 (Evaluate) a. Create a notepad file as per the following fields Slno name th1 th2 th3 th4 th5 total % grade b. Import this notepad file into excel sheet using „data◊from text" option. c. Grade is calculated as, i. If %>=90, then grade A ii. If %>=80 and =70 and =60 and	

7	Create a power-point presentation with minimum 5 slides. a. The first slide must contain the topic of the presentation and name of the presentation. C5 (Evaluate) b. Must contain at least one table. c. Must contain at least 5 bullets, 5 numbers. d. The heading must be, font size:32, font-face: Arial Rounded MT Bold, font-color: blue. e. The body must be, font size: 24, font-face: Comic Sans MS, font-color: green. f. Last slide must contain „thank you‟
8	Create a power-point presentation with minimum 10 slides 24 C5 (Evaluate) a. Use word art to write the heading for each slides. b. Insert at least one clip-art, one picture c. Insert at least one audio and one video d. Hide at least two slides
9	Create a power-point presentation with minimum 5 slides a. Use custom animation option to animate the text; the text must move left to right one line at a time. C5 (Evaluate) b. Use proper transition for the slides.
10	Create a database using MS Access "Student" with, C5 (Evaluate) a. At least one table named "mark sheet" with field name "student name, roll number, mark1, mark2, mark3, mark4, total" b. The data types are, student name: text, roll number: number, mark1 to mark4: number, total: number. Roll number must be the primary key. c. Enter data in the table. The total must be calculated using update query. d. Use query for sorting the table according to the descending/ascending order of the total marks
11	With addition to the table above, C5 (Evaluate) a. Add an additional field "result" to the "mark sheet" table. b. Enter data for at least 10 students c. Calculate the result for all the students using update queries, if total>=200, then pass, else fail. d. Search the students, whose name starts with "sh". e. Show the names and total marks of the students who have passed the examination.
Note:	

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

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

Mapping of Assessment with COs

Nature of Assessment	CO1	CO2	CO3	CO4
VIVA	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓
University Examination	✓	✓	✓	✓

Feedback Process	3. Student's Feedback 4. Course Exit Survey
References:	1. Microsoft Word, Excel, and PowerPoint: Just for Beginners, 2015 2. Microsoft Excel Formulas & Functions For Dummies, 5ed, 2020.

SEMESTER - III

Course Code	Course Title
130103111	Strength of Materials
130103112	Strength of Materials Lab
130103113	Surveying
130103114	Surveying Lab
	SEC-I (Civil Engineering Drawing Lab)
	MGE-III
	VAC-III
	AECC-III
130103116	Summer Internship
Program Elective-I Pool (Choose One from the pool)	
130103117	Civil Infrastructure and Society
130103115	Building Construction & Material
130103119	Introduction to Sustainable Development
130103120	Air, Noise Pollution and Control
Additional Subjects for Specialization Artificial Intelligence and Data Science	
130103121	Introduction To Data Science
130103122	Introduction To Data Science Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103111
Course Title	**Strength of Materials**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	NIL
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	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	1	1	1	1	2	2	1	3	1	1
CO2	3	3	3	3	2	-	-	2	1	2	2	-	3	1	1
CO3	3	3	3	2	2	-	-	2	1	2	2	-	3	1	1
CO4	3	3	3	2	1	1	-	2	1	2	2	-	3	1	1
Average	3	3	3	3	1.5	1	1	2	2	2	2	1	3	1	1

Course Content:

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

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

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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. **2.** Feedback between the semester through google forms

References:

Text Books:

1 Er. R.K Rajput (2011), ISBN No. 81/219/2594/0 Engineering Mechanics, 7th Edition, S Chand publications.

Reference Books:

1.F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill.

2.R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.

3.Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press.

4. Shames and Rao (2006), Engineering Mechanics, Pearson Education.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103112
Course Title	**Strength of Materials Lab**
Academic Year	II
Semester	III
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Properties of materials, Stresses and strains, Shear Force, Columns and Struts, Deflection of beams and failures theory and Bending Moment

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

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

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

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

Course Content:

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

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

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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						

Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103113
Course Title	**Surveying**
Academic Year	II
Semester	III
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

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

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

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

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

Course Content:

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

Unit	**Content**	
1	Define plane surveying C1 (Remember), Describe the conventional tape	

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:

Text Books

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

Reference books

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

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103114
Course Title	**Surveying Lab**
Academic Year	II
Semester	III
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

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

CO1	Understand 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	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**3**	**2**						**2**	**1**	3	-	3
CO2	**3**	**3**	**3**	**3**	**2**						**2**	**1**	3	-	3
CO3	**3**	**3**	**3**	**3**	**2**							**1**	3	-	2
CO4	**3**	**3**	**3**	**3**	**2**							**1**	3	-	3
CO5	**3**	**3**	**3**	**3**	**2**						**2**	**1**	3	-	2
Average	**3**	**3**	**3**	**3**	**2**						**1.2**	**1**	3	-	2.6

Course Content:

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

Experiment No.	Content

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

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

Program Elective - I

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103117
Course Title	**Civil Infrastructure and Society**
Academic Year	II
Semester	III
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	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	2	3	1
CO2	2	3	2	3	3	2	2	3	3	3	3	3	2	3	1
CO3	1	2	1	2	1	2	1	2	3	3	3	3	2	3	2
CO4	3	3	3	2	3	2	3	3	2	1	2	1	2	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	2	3	1.5

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 (Understanding), Evaluate existing infrastructure practices and policies C5 (Evaluate). Assess the effectiveness of current approaches to infrastructure development and identify areas for improvement C5 (Evaluate), Assess the impact of existing infrastructure on economic growth, social equity, and sustainable urbanization C5 (Evaluate)	
2	Understanding of infrastructure planning and design C2 (Understanding), Understanding the principles and decision-making processes involved in developing infrastructure projects C2 (Understanding), Application of environmental impact assessment and sustainability considerations during the infrastructure planning and design C3 (Application), Investigate the Environmental impact assessment methods to evaluate the potential effects of infrastructure projects on ecosystems, natural resources, and communities C6 (Create), Evaluate the long-term sustainability and performance of infrastructure systems C5 (Evaluate).	
3	Discuss theRoad networks, public transit systems, transportation infrastructure and intelligent transportation systems C2 (Understanding), designing and optimizing road networks, such as traffic flow, capacity, and safety C6 (Create), analyze the complexities and challenges associated with transportation infrastructure C4 (Analysis), evaluate existing transportation infrastructure practices and policiesC5 (Evaluate). 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 (Understanding), analyze the complexities and challenges associated with water supply systems and management C4 (Analysis), evaluate the performance of water supply infrastructure by analyzing factors such as water quality, reliability, and resilience to climate change C5 (Evaluate). Assess the performance of water supply infrastructure evaluate existing water supply systems, wastewater management practices, stormwater management strategies, and water conservation efforts C5 (Evaluate).	
4	Understanding of equity and accessibility in infrastructure development C2 (Understanding), apply climate change adaptation and mitigation strategies by integrating resilience measures into infrastructure design C3 (Application), analyze the complexities and trade-offs associated with equity and accessibility in infrastructure development C4 (Analysis) analyze the vulnerabilities of infrastructure systems to climate change impacts C4 (Analysis), assess the effectiveness of adaptation and	

	mitigation measures C5 (Evaluate), and identify potential synergies between climate action and sustainable infrastructure development C2 (Understanding), understanding of equity and accessibility in infrastructure development C2 (Understanding), Applying knowledge of equity and accessibility in infrastructure development C3 (Application), analyze the performance of sustainable infrastructure policies and practices by considering environmental, social, and economic indicators C4 (Analysis), analyze the performance of sustainable infrastructure policies and practices by considering environmental, social, and economic indicators C4 (Analysis)

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:	
	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.

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103115
Course Title	**Building Construction & Material**
Academic Year	II
Semester	III
Number of Credits	2
Course Prerequisite	NIL
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	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**P01 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3		3				3				3	3	2	1
CO2	3	3		3	3				3	2	3		3	2	1
CO3		3	3	3	3	2							3	1	2
CO4	3	3		3		3		2			3		3	1	2
CO5	3	3		3		3		2			1		3	1	2
CO6	3	3		3	2	1	2					3	3	1	3
Average	2.5	3	0.5	3	1.3	1.5	0.3	1.1	0.5	0.3	1.1		3	1.33	1.73

Course Content:

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

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

	Evaluate existing preventive measures, damage assessment techniques, and repair and rehabilitation methods C6 (Create) Preventive measures during construction for a durable and safe building structures, assessment of damage due to faulty construction and natural and manmade calamities, repair and rehabilitation of structures

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	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.

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University
NAAC A+

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103119
Course Title	**Introduction to Sustainable Development**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	NIL
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P01 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	3	2	2	2	2	1	1	3	3	2
CO2	3	3	3	3	2	2	2	2	2	1	1	1	3	3	2
CO3	3	3	3	3	2	2	2	2	2	2	1	1	3	3	2
CO4	3	3	3	3	2	3	3	2	2	1	1	1	3	2	2
Average	3	3	3	3	2	2.5	2.25	2	2	1.5	1	1	3	2.75	2

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 (Analysis), focusing on ecological systems and the management of natural resources, Evaluate climate change and its impacts on the environment C5 (Evaluate), Assess the effectiveness of climate change mitigation strategies and their potential for reducing greenhouse gas emissions C5 (Evaluate), Analyze the challenges and opportunities in implementing sustainable water and waste management practices C4 (Analysis), Critically evaluate the current state of sustainability efforts and their impact on addressing global challenges C5 (Evaluate), Analyze the effectiveness of policies, initiatives, and technologies in achieving sustainable development goals C4 (Analysis), Propose innovative solutions and strategies for promoting environmental sustainability, considering the complex interactions between ecological systems, natural resources, and human activities C6 (Create)
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 (Analysis), Evaluate community engagement and participatory approaches in sustainable development initiatives C5 (Evaluate), Assess the impact of sustainable development on health and well-being C5 (Evaluate). evaluate the social equity, justice, and human rights aspects of sustainable development C5 (Evaluate) 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 (Analysis), Evaluate the benefits and challenges of transitioning towards a circular economy C5 (Evaluate), Evaluate different economic models for sustainable development, such as the green economy, inclusive growth, and decoupling C5 (Evaluate), 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 (Evaluate)
3	Concept of Renewable energy sources and technologies C2 (Understanding), evaluation of Energy efficiency and conservation C5 (Evaluate), analysis of Sustainable transportation systems and mobility C4 (Analysis), application of innovation and technology in energy and transportation sectors C3 (Application)
4	Concept of Sustainable Urban Planning and Design C2 (Understanding), explain Smart cities and urban resilience C2 (Understanding), analysis of Sustainable transportation and infrastructure in cities C4 (Analysis),

	Application of Social and economic aspects of urban sustainability C3 (Application), Analysis of successful and challenging sustainability projects C4 (Analysis)

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:	
	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
Course Code	130103120
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	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**P01 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3	2	3	2	1	1	2	1	1	3		1
CO2	3	3	3	3	2	2	2	1	1	1	2	1	3	1	1
CO3	3	3	3	3	2	3	2	2	1	2	1	1	3	3	1
CO4	3	3	3	3	2	2	2	2	1	1	2	1	3	1	1
Average	3	3	3	3	2		1		1			1	3	1.67	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 (Create), Discuss the Source inventory C2 (Understanding), Analysis of global warming and ozone layer depletion C4 (Analysis), Understanding the Basic Principles and sources of Sampling C2 (Understanding), Analysis of pollutants C4 (Analysis)			
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 (Understanding); 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 (Analysis), Analyze the principles and techniques involved in controlling gaseous emissions using adsorption, absorption, condensation, and combustion C4 (Analysis), 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 (Understanding), concept of air quality monitoring and its role in assessing and managing air pollution (C2 (Understanding), C4, Analyze) Analyze air pollution control efforts and their effectiveness in reducing pollutants C4 (Analysis), Evaluate the legislation and enforcement mechanisms related to air pollution control C5 (Evaluate), Compare and contrast different methods used in air quality monitoring including sampling techniques, data analysis, and the use of monitoring equipment and technologies C4 (Analysis), Evaluate the role of zoning and town planning regulations in preventing the establishment of polluting industries in sensitive areas C5 (Evaluate), Assess the effectiveness of various air pollution control measures and strategies C5 (Evaluate), Critically evaluate the methodologies used in Environmental Impact Assessments C5 (Evaluate)			
4	Identify and describe the sources of noise pollution including both environmental and industrial sources C2 (Understanding), Explain the effects of noise pollution on human health and the environment C2 (Understanding), Understand the fundamentals of sound generation and propagation C2 (Understanding), Differentiate between various types of			

	sound level meters and their components C4 (Analysis), Evaluate noise prevention and control measures in both environmental and industrial setting C5 (Evaluate), Analyze the effectiveness of different strategies and techniques employed to mitigate noise pollution C4 (Analysis), Assess the impact of noise pollution on different stakeholders, including individuals, communities, and ecosystems C5 (Evaluate), Critically evaluate the existing noise control measures and legislation C5 (Evaluate)

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:	
	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.

SPECIALIZATION

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103121
Course Title	**Introduction to Data Science**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	Nil
Course Synopsis	In this course, Students will learn about data science concepts, relationship between data and Visualization of data

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

CO1	To understand the data science fundamentals and process.
CO2	To learn to describe the data for the data science process
CO3	To learn to describe the relationship between data.
CO4	To present and interpret data using visualization libraries

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

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

Course Content:				
L (Hours/Week)		T (Hours/Week)	P (Hours/Week)	Total Hour/Week
3		0	0	3
Unit	Content			Competencies
1	Introduction to Data Science – Evolution of Data Science (C1, Knowledge) Classify Data Science Roles – Stages in a Data Science Project (C2, Comprehension), Applications of Data Science in various fields, Data Security Issues. (C3, Application)			
2	Describe Data Collection Strategies – Data Pre-Processing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization. (C2, Comprehension), Exploratory Data Analytics: Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis, Box Plots – Pivot Table, Heat Map (C3, Application), Design Correlation Statistics – ANOVA. (C6, Synthesis)			
3	Model Evaluation using Visualization (C5, Evaluation), Construct Residual Plot, Distribution Plot, Polynomial Regression and Pipelines (C6, Synthesis), Measures for In-sample Evaluation (C5, Evaluation), Prediction and Decision Making (C5, Evaluation)			
4	Out-of-Sample Evaluation Metrics – Cross (C5, Evaluation), Validation, Overfitting, Underfitting and Model Selection (C5, Evaluation), Prediction by using Ridge Regression (C5, Evaluation), Testing Multiple Parameters by using Grid Search (C4, Analysis)			

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**
Assignment / Presentation	✓	✓	✓	✓	✓	✓
Unit test	✓	✓	✓	✓	✓	✓
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:	1. Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2016. 2. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2015. 3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013 4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130103122
Course Title	**Introduction to Data Science Lab**
Academic Year	II
Semester	III
Number of Credits	3
Course Prerequisite	Nil
Course Synopsis	In this course, Students will learn about data science concepts, relationship between data and Visualization of data.

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

CO1	Apply appropriate tools for Data Collection and Manipulation
CO2	Implement Data Visualization Methods for getting insights of Data.
CO3	Analyze Data by implementing Concepts of Data Preparation
CO4	Perform three-dimensional plotting and visualization

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

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

Course Content:

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

Experiment No.	Content

1.	Write a program to create a list, manipulate and slice it. (C1, Knowledge)
2.	Write a program for Accessing/Importing and Exporting Data (C2, Comprehension)
3.	Apply basic statistical methods on Sample Datasets (C3, Application)
4.	Consider the sample data Mean velocity: 0.2474, 0.1235, 0.1737, 0.1824 Standard deviation of velocity: 0.3314, 0.2278, 0.2836, 0.2645 (C2, Comprehension)
5.	Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation (C4, Analysis)
6.	Bivariate analysis: Linear and logistic regression modeling (C4, Analysis)
7.	Three-dimensional plotting (C6, Synthesis)
8.	Analyze the data distributions using box and scatter plot (C4, Analysis)
9.	Analyze the correlation matrix (C4, Analysis)

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

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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**	**CO 3**	**CO 4**	**CO 5**	**CO 6**
VIVA	✓	✓	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓	✓	✓
Demonstration	✓	✓	✓	✓	✓	✓
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

References:

1.Jojo Moolayil, "Smarter Decisions: The Intersection of IoT andData Science", PACKT, 2016.
2.Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly,2015.
3.David Dietrich, Barry Heller, Beibei Yang, "Data Science and Bigdata Analytics", EMC 2013
4.Raj, Pethuru, "Handbook of Research on Cloud Infrastructures forBig Data Analytics", IGI Global.

SEMESTER - IV

Course Code	Course Title
130104111	Structural Analysis
130104112	Fluid Mechanics
130104113	Fluid Mechanics Lab
130104114	Concrete Technology
130104115	Concrete Technology Lab
	SEC-II (GIS Lab)
	VAC-IV
	AECC-IV
Program Elective-II Pool (Choose One from the pool)	
130104117	Advanced Surveying
130104118	Environment Impact Assessment
130104119	Engineered Systems and Sustainability
130104120	Introduction to AI and Data Analytics for Civil Engineering
Additional Subjects for Specialization Artificial Intelligence and Data Science	
130104121	Data Analysis using Python
130104122	Data Analysis using Python Lab

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

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

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

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

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

Course Content:

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

Unit	Content

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:

Text Books

1. R.C. Hibbler , Structural Analysis (2011) , Pearson Education.
2. S. Ramamrutham, Theory of Structures, Dhanpatrai Publishers

Reference Books

1. Jain,O.P.and Jain, B.K., "Theory &Analysis of Structures". Vol.I& II Nem Chand brothers.
2. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill
3. Chukia Wang
4. Coates,R.C.,Coutie,M.G. & Kong, F.K., "Structural Analysis", English Language BookSociety& Nelson.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104112
Course Title	**Fluid Mechanics**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Fluid mechanics includes fluid statics and dynamics, conservation of mass, momentum, and energy in incompressible flow & flow of a real fluid--including laminar and turbulent flow, dimensional analysis and similitude & the applications to engineering problems.

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

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

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

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

Course Content:

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

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

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

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	26
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	6
Problem Based Learning (PBL)	9
Case/Project Based Learning (CBL)	--

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

Assessment Methods:

Formative	Summative
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:

Text Books

1. R.K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines (2011), ISBN No. 978-81-318-0815-3 9th Publications, Laxmi Publication.

Reference Books

1. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, Katson Publishing House.
2. V.L. Streeter, Fluid Mechanics, McGraw Hill Book Co.
3. K. Subramanian, Fluid Mechanics and hydraulic machines McGraw Hill Book Co.

	4. P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104113
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**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**		**3**	**3**	**2**			**2**		**2**	**3**	3	1	1
CO2	**3**	**3**		**3**	**3**	**2**			**2**		**2**	**3**	3	1	1
CO3	**3**	**3**		**3**	**3**	**2**			**2**		**2**	**3**	3	1	1
CO4	**3**	**3**		**3**	**3**	**2**			**2**		**2**	**3**	3	1	1
Average	**3**	**3**		**3**	**3**	**2**			**2**		**2**	**3**	3	1	1

Course Content:

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

Experiment No.	**Content**
1.	Conducting experiments to verify Bernoulli's theorem C4 (Analysis)
2.	Determination of the Coefficient of discharge of given Venturi-meter C5 (Evaluate)
3.	Determination of the Coefficient of discharge of given rectangular notch C5 (Evaluate)

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

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

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

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

COs	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**PO**	**PO**	**P0**	**PS**	**PS**	**PS**

	O1	O2	O3	O4	O5	O6	O7	O8	O9	10	11	12	O1	O2	O3
CO1	3	3	3	3	3	3	3	3	2	3	3	3	3	2	1
CO2	3	3	3	3	3	3	1	2	2	2	3	3	3	2	2
CO3	2	3	2	3	3	2		3	2	1	3	2	3	2	2
CO4	2	3	3	3	3	2	1	2	2	2	3	2	3	2	2
CO5	2	3	3	3	3	3	2	3	2	2	3	3	3	2	1
CO6	2	3	3	3	3	3	1	3	2	2	2	1	3	2	2
Average	2.3	3	2.8	3	3	2.6	1.1	2.6	2	2	2.8	2.1	3	2	2

Course Content:

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

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

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	21
Practical	--
Seminar/Journal Club	04
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	4

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

Assessment Methods:

Formative	**Summative**
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:

Text Books

1. Gambhir, M.L., Concrete Technology (2012) ISBN No. 978-00-07-015133, 9th Edition, Tata McGraw Hill.
2. Mehta and Montiero, Properties of Concrete, Pearson.

Reference books:-

1. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co.
2. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi.
3. Nevile, Properties of Concrete, Longman Publishers.

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

Course Outcomes: At the end of the course students will be able to:	
CO1	To identify suitable materials to be used in the cement concrete by conducting various tests as per BIS code.
CO2	Test all the concrete materials as per BIS code.
CO3	Design the concrete mix using ACI and BIS code methods.
CO4	Determine the properties of fresh and hardened of concrete.
CO5	Design special concretes and their specific applications and use of admixtures.
CO6	Use of non-destructive testing equipment
Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes:	

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

Course Content:				
L (Hours/Week)		**T (Hours/Week)**	**P (Hours/Week)**	**Total Hour/Week**
0		**0**	**2**	**2**
Experiment No.	**Content**			
1.	Compressive Strength test of Cement Cube C4 (Analysis)			
2.	Determine the specific gravity of fine sand (C4, C5)			
3.	Determine Flakiness, elongation and hardness of coarse aggregates (C4, C5)			
4.	Determine soundness of cement (C4, C5)			
5.	Workability by Compaction Factor, Slump Test (C4, C5)			
6.	Determination of Constituents of Hardened Mortar (C4, C5)			
7.	Mix Design by IS Code Method (C4, C5, C6)			
8.	Compressive strength of Concrete cube (C4, C5)			
9.	Compressive strength of Concrete cylinder (C4, C5)			
10.	Compressive strength of Concrete Using NDT (C4, C5)			

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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
Course Code	
Course Title	**GIS Lab**
Academic Year	II
Semester	IV
Number of Credits	2
Course Prerequisite	
Course Synopsis	GIS technology for spatial design/analysis; applications in facilities management, urban infrastructure, water resources, environmental and transport engineering

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

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

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P01 2	PS O1	PS O2	PS O3
CO1	2	2	2	2	3	3	3	1	2	1	2	3	3	3	2
CO2	3	2	2	2	3	3	3	2	2	2	2	3	3	3	2
CO3	3	2	2	2	3	2	2	1	2	1	2	2	3	3	2
CO4	3	2	2	2	3	2	2	2	2	2	2	2	3	3	2
CO5	3	3	3	3	3	3	3	1	2	1	2	3	3	3	2
Avera ge	2.8	2.2	2.2	2.2	3	2.6	2.6	1.4	2	1.4	2	2.6	3	3	2

Course Content:

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

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

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
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

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104117
Course Title	**Advanced Surveying**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	Surveying
Course Synopsis	Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

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

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

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

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

Course Content:

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

Unit	**Content**	
1	Basic understanding and concept of curves (C1, C2); differentiate the	

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:

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

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University
NAAC A+

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104118
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	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	2	2	2	1	1	1	3	2	2
CO2	3	3	3	3	2	2	2	2	1	1	1	1	3	2	2
CO3	3	3	3	3	2	2	2	2	2	1	1	1	3	2	2
Average	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	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 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 (Evaluate), 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 (Analysis),

	Selection of software packages for EIA and Expert systems in EIA C5 (Evaluate)
3	Basic concept of social impact assessment (C1, C2), Relation between social impacts and change in community and institutional arrangements C4 (Analysis), Selecting, testing and understanding significant social impacts C5 (Evaluate), Development of Social impact assessment model and the planning process C6 (Create), Investigate the communities in transition - neighborhood and community impacts C6 (Create), Environmental costing of projects C6 (Create)
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 (Analysis)

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**			
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:	
	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
Course Code	130104119
Course Title	**Engineered System and Sustainability**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	Introduction to Structures
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	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	1	1	2	1	1	1	2	3	1
CO2	3	3	3	3	2	2	2	2	2	1	1	1	2	3	1
CO3	3	3	3	3	2	2	1	1	2	1	1	1	2	3	1
CO4	3	3	3	3	2	2	2	1	2	2	1	1	2	3	1
CO5	3	3	3	3	2	2	2	1	2	2	1	1	2	3	1
Avera	3	3	3	3	2	2	1	1	2		1	1	2	3	1

ge																

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 (Analysis), Application of engineered systems in achieving sustainability goals C3 (Application), Investigate the challenges and opportunities for sustainable engineering C6 (Create); Life cycle assessment (LCA) and environmental footprint analysis C4 (Analysis),
2	Basic concept of sustainable materials and techniques C2 (Understanding), 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 (Analysis), Development of Net-zero energy and energy-positive buildings C6 (Create), 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 (Evaluate), Cost-benefit analysis and economic feasibility C4 (Analysis); Compare the sustainable engineering technologies C4 (Analysis), 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**	**CO5**	
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:

Text 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
Course Code	130104120
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	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	1	1	1	1	1	1	2	-	1
CO2	3	3	3	3	2	1	1	1	2	1	1	1	2	-	1
CO3	3	3	3	3	2	1	1	2	1	1	2	1	2	-	1
CO4	3	3	3	3	2	1	1	1	1	2	1	1	2	-	1
Average	3	3	3	3	2	1	1	1.25	1.25	1.25	1.25	1	2	-	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 (Application); investigate the role of AI and data analytics in decision-making processes along with Ethical considerations C6 (Create); distinguish the data types and sources in civil engineering C4 (Analysis); Compare the Data collection techniques and sensors C4 (Analysis)
2	Understanding of fundamental of machine learning (C1, C2), compare the supervised and unsupervised learning techniques and their application in civil engineering (C3, C4), Model selection and evaluation C5 (Evaluate), Applications of deep learning in civil engineering C3 (Application), Distinguish artificial neural networks (ANN) with Convolutional neural networks (CNN) C4 (Analysis); compare feedforward and backpropagation algorithms C4 (Analysis)
3	Application of Linear regression and its applications in civil engineering C3 (Application), Compare the linear and non-linear regression model C4 (Analysis), Performance evaluation of prediction models C5 (Evaluate), distinguish binary and multiclass classification techniques C4 (Analysis), application of support vector machines (SVM) in civil engineering C3 (Application)
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 (Application), Develop model for the solution of above problems C6 (Create)

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:	
	Books Artificial Intelligence and Machine Learning Techniques for Civil Engineering, by Vagelis Plevris (Editor), Afaq Ahmad (Editor), Nikos D. Lagaros (Editor), IGI Global (30 June 2023).

SPECIALIZATION

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104121
Course Title	**Data Analysis using Python**
Academic Year	II
Semester	IV
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course combines the advantages of both Python and Data science. Here, students will learn to apply the ideas of analytics in real world problems. Moreover, multiple mathematical operations and scientific computing will be taught using existing and mature python-based libraries.

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

CO1	Understand statistical analysis using Python
CO2	Understand probability distribution.
CO3	Understand statistical test.
CO4	Understanding the concept behind ANOVA.

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

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

Course Content:

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

Unit	Content	Competencies

1	Describe Data Analysis using Python (C2, Comprehension), Define Vectors, Factors, Lists, Matrix and Data Frames, Scatter Plot in Python, Add the Plot Main and Axis Lebel Text, Change the Plot Characters (pch) from Circles to Plus Signs, Filtered Data, Add text to the plot (C1, Knowledge), Demonstrate Make plot colorful, and text bigger and bold, Multiple pairs of scatter diagrams, Time Series Plot, Histogram, Box and Whisker Plot (C3, Application), Descriptive Statistics, Descriptive Statistics Using psych Package (C2, Comprehension)
2	Define Probability Definition, Probability - Union and Intersection, Probability – The Law of Addition, Multiplication and Conditional Probability, Factorial, Permutations and Combinations, Central Limit Theorem, Central Limit Theorem Demonstration Using Python, Normal Probability Distribution, Python Functions for Normal Distribution - rnorm, pnorm, qnorm and dnorm, Plotting Normal Distribution Using Python Functions (C1: Knowledge), Describe Binomial Probability Distribution, Python Functions for Binomial Distribution- rbinom, pbinom, qbinom and dbinom, Plotting Binomial Distribution Using Python Functions, Binomial Distribution using Visualize Package, Poisson Distribution, Python Functions for Poisson Distribution - rpois, ppois, qpois and dpois, Plotting Poisson Distribution Using Python Functions, Poisson Distribution using Visualize Package (C2, Comprehension)
3	Describe inferential statistics, Types of Mean and Variance Tests, Hypothesis Testing –Types of Errors, p value. (C2, Comprehension), Explain Hypothesis Testing - One Sample Z Test, One Sample z Test, One Sample z Test using BSDA Package, One Sample t Test, One Sample t Test, Visualizing One Sample t Test Results using Visualize Package, One Sample Variance Test - Chi Square Test, One Sample Variance Test Using Envstats Package. (C2, Comprehension), Demonstrate Chi Square Distribution for One Sample Variance Test, Two Sample Z Test, Two Sample Z Test, Visualizing Two Sample Z Test Using Visualize Package, Two Sample Z Test for Populations with Different Means, Two Sample t Test (Equal Variance) Using Python, Two Sample t Test (Unequal Variance) Using Python, Paired t Test, Paired t Test, Two Sample Variance Test Using F Test, Two Sample Variance Test (F Distribution, Visualizing Two Sample Variance Test Results using Visualize Package (C3, Application)
4	Explain the concept behind ANOVA without doing any calculation. (C2, Comprehension), Define Formulas and calculations in ANOVA, ANOVA Example Using Manual Calculations. (C1, Knowledge), Analysis of

	Variance (ANOVA), Contingency Table. (C4, Analysis)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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**
Assignment / Presentation	✓	✓	✓	✓	✓	✓
Unit test	✓	✓	✓	✓	✓	✓
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:	
	Text Books 1. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython (2 ed.), O′Reilly, 2017. ISBN 978-1491957660. 2. Klosterman, Stephen, Data Science Projects with Python: A Case Study Approach to Successful Data Science Projects Using P (1 ed.), Packt Publishing Limited, 2019. ISBN 978-1838551025.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130104122
Course Title	**Data Analysis using PythonLab**
Academic Year	II
Semester	IV
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Understand concept of data analysis using Python

Course Outcomes:

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

CO1	Understand statistical analysis using Python
CO2	Understand probability distribution.
CO3	Understand statistical test.
CO4	Understanding the concept behind ANOVA.

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

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

Course Content:

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

Experiment No.	Content
1.	Generate a smooth plot of your underlying law of nature and overlay with the discrete samples (C1, Knowledge).

2.	Define a source of noise, simulating using an imperfect apparatus to make measurements of nature. Here, even with no input from the outside world, the instrument may nevertheless output a non-zero value of whatever it is measuring. (C1, Knowledge)
3.	Calculate the mean and standard deviation of your 30 noise samples. (C1, Knowledge)
4.	Plot a histogram of the noise samples (C1, Knowledge)
5.	Perform a nonlinear least squares fit of your model function to your data. Report what the best fit values of your fit parameter, as well as its uncertainty (C1, Knowledge)
6.	Plot a smooth line of the best fit model, overlaid with the measurements. (C1, Knowledge)
7.	Find the mean value of the noise as a good estimate of the bias (C1, Knowledge)
8.	Plot the fit residuals from the new fit (C1, Knowledge)
9.	Write a loop structure to perform 1000 such experiments, with new noise for each new set of observations, storing every fit parameter for later processing. Here we suppose we “zero-out” our instrument in the beginning, to eliminate any systematic bias in the measurements (C1, Knowledge)
10.	Calculate the standard deviation of each of these groups (C1, Knowledge)

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**	**CO 3**	**CO 4**	**CO 5**	**CO 6**
VIVA	✓	✓	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓	✓	✓
Demonstration	✓	✓	✓	✓	✓	✓
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

References:	**Textbooks:** 1. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython (2 ed.), O′Reilly, 2017. ISBN 978-1491957660.2. Klosterman, Stephen, Data Science Projects with Python: A Case Study Approach to Successful Data Science Projects Using P (1ed.), Packt Publishing Limited, 2019. ISBN 978-1838551025.

SEMESTER - V

Course Code	Course Title
130105111	Reinforced Concrete Structures-I
130105112	Hydrology
130105113	Soil Mechanics
130105114	Soil Mechanics Lab
130105115	Engineering Geology
130105116	SEC-III (BIM Lab)
130105117	Industrial Training - I / MOOC Course
	Personality Development & Career Building
Program Elective-III Pool (Choose One from the pool)	
130105118	Advanced Structural Analysis
130105119	Open channel flow
130105120	Disaster Control and Management
130105121	Earth and Environment
Additional Subjects for Specialization Artificial Intelligence and Data Science	
130105122	Introduction to AI and ML
130105123	Introduction to AI and ML Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105111
Course Title	**Reinforced Concrete Structures-I**
Academic Year	III
Semester	V
Number of Credits	4
Course Prerequisite	NIL
Course Synopsis	Students will learn the concept of working stress method and limit state method for various reinforced concrete sections. Students will also learn the concept of design of one way, two way and circular slabs, short column and long column, axially and eccentrically loaded columns. Students will understand the concept of footings and retaining wall design as well.

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

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

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

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

Course Content:

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

Unit	Content
1	Basic knowledge and concept of reinforced concrete structure (plain concrete, steel) and design of concrete structure (C1, C2); basic concept of basic assumptions and permissible stresses in concrete and steel for

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:

Text Books

1 RCC Designs, B.C Punmia (2012),10th Edition, ISBN No. 978-81-318-0942-6, Laxmi Publications

Reference books

1. IS-456-2000.
2. SP-16(S&T)-1980, Design Aids for Reinforced Concrete to IS: 456, BIS, N.Delhi.
3. SP-34(S&T)-1987 Handbook on Concrete Reinforcement and Detailing`, BIS
4. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand &Bros., Roorkee.
5. Reinforced Concrete, I.C.Syal&A,K,Goel, A.H,Wheeler&Co.Delhi.
6. Reinforced Concrete Design, S.N.Sinha, TMH Pub., and N.Delhi.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105112
Course Title	**Hydrology**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Hydrology is the study of water in the Earth's system. This course introduces students to the fundamental principles of hydrology and their application to water resource management. The course covers the basic principles of hydrologic cycle, precipitation, evapotranspiration, runoff, streamflow, and groundwater. The laboratory experiments are designed to supplement the theory covered in the course. The experiments cover measurement of streamflow, groundwater, and precipitation, as well as water quality testing.

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

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

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

COs	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**1**
CO2	**3**	**2**	**2**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**1**
CO3	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**1**
Average	**3.0**	**2.3**	**2.0**	**3.0**	**1.3**	**2.7**	**3.0**	**3.0**	**3.0**	**1.7**	**2.0**	**2.7**	**3**	**1.33**	**1**

Course Content:

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

Unit	Content	Competencies
1	Basic understanding of hydrological cycle and rainfall measurement (C1, C2); application of hydrology to engineering problems C3 (Application); explain drainage basins and its characteristics, stream geometry,	

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	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
Course Code	130105113
Course Title	**Soil Mechanics**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
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	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	2		1	2	3	3	3	3	2	2
CO2	3	3	3	1	1	2	3	2	2	3	3	3	3	2	2
CO3	3	3	2	1	2	2	3	3	2	3	3	3	3	2	1
CO4	3	2	2	2	2	2	1	2	3	2	3	3	3	2	1
Average	2.8	2.8	2.5	1.5	1.5	2	1.8	2	2.3	2.8	3	3	3	2	1.5

Course Content:

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

3	0	0	3

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative

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. **2.** Feedback between the semester through google forms

References:

Text Books

1. Dr. K.R. Arora, Soil Mechanics and Foundation Engineering (2011), ISBN No. 81-8014-112-8, Seventh Edition, Standard Publishers Distributors, Delhi.

Reference books

1. Soil Mechanics and Foundation Engineering by Dr. P.N. Modi (ISBN-13: 9788189401306)
2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, Wiley Eastern Ltd., New Delhi, 2016
3. William Powrie, Soil Mechanics: Concepts and Applications, Spon Press.
4. Soil Mechanics and Foundation Engineering by B.N.D. Narsinga Rao, 2015, Wiley India Pvt. Ltd. New Delhi.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	B.Tech.
Course Code	130105114
Course Title	**Soil Mechanics Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
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	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	2	2		2		2	2	1		1	3	2	2
CO2	3	2		2		1	2	1	1	1	1	1	3	2	2
CO3	3	2	2	2		1	2	2	2	2	2	2	3	2	1
CO4	3	2		2		1	2	1	2	1	1	1	3	2	1
CO5	3	3	3	2	1	2	2	3	2	1	2	3	3	2	2
CO6	3	2	2	2	2	1	2	1	1	1	2	1	3	2	2
Average	3	2.3	1.8	2	0.8	1.3	2	1.8	1.8	1.3	1.8	1.8	3	2	1.67

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

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

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

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

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

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3	3			3	2	3	2	3	3	1	1
CO2	3	3	3	3	2	2	3	3	3	3	3	3	3	1	1
CO3	3	3	3	3	3			3	2	2	2	2	3	1	2
CO4	3	3	3	2	3		2	2	3	3	2	3	3	1	1
Average	3	3	3	2.8	2.8	0.5	1.3	2.8	2.5	2.8	2.3	2.8	3	1	1.25

Course Content:

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

Unit	Content
1	Definition of a crystal and mineral C1 (Remember); relationship between

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:

Text Books

S.K Garg, Physical and Engineering Geology (2012), 7th Edition ISBN No. 81-7409-032-0, Khanna Publications.

References

1. Reddy, V. Engineering Geology for Civil Engineers; Oxford & IBH, 1997,New Delhi
2. N. Chennakesavalu, A Test Book of Engineering Geology, Macmillan Publishers, First Publishers, Published 2004

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

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

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

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

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

Course Content:

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

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

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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	✔	✔	✔			
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 – III

Faculty of Engineering & Technology

Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105118
Course Title	**Advanced Structural Analysis**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	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	**P O1**	**P O2**	**P O3**	**P O4**	**P O5**	**P O6**	**P O7**	**P O8**	**P O9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	3	3	2	2	1	1	1	1	1	1	3	1	1
CO2	3	3	3	3	2	2	2	1	2	1	1	1	3	1	1
CO3	3	3	3	3	2	2	1	1	1	1	1	1	3	1	-
CO4	3	3	3	3	2	2	1	1	1	2	1	1	3	1	-
Average	3	3	3	3	2		1.67	1	1.67	1.567	1	1	3	1	1

Course Content:

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

3	0	0	3

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	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
Course Code	130105119
Course Title	**Open Channel Flow**
Academic Year	III
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	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	3	2	1
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	3	1	1
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**	3	1	1
Average	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**	3	1.33	1

Course Content:

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

3	**0**	**0**	**3**

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

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	29
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	12
Problem Based Learning (PBL)	--
Case/Project Based Learning (CBL)	--
Revision	04

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

Assessment Methods:

Formative	Summative
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	Student's Feedback

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

References:

Text Books

1. Subramanya,K.,(2008) Flow in Open Channels,3rd Edition, ISBN No. 978-132-449-6, TataMcGraw-Hill

Reference Books

1.V.T.Chow (2009), Open Channel Hydraulics, Blackburn Press.
2. Asawa,G.L.,(2010), Fluid Flowing Pipes and Channels, CBS Publishers.
3. Chanson, H.(2004),The Hydraulics of Open Channel Flow: An Introduction, Elsevier Scientific.
4. M. Hanif Chaudhry (2007), Open Channel Flow, Springer.
5. Henderson, F.M., (1966) Open Channel Flow, PHI.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105120
Course Title	**Disaster Control and Management**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
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	PSO1	PSO2	PSO3
CO1	3	3	3	3	3			3	2	3	2	3	3	3	1
CO2	3	3	3	3	2	2	3	3	3	3	3	3	3	3	1
CO3	3	3	3	3	3			3	2	2	2	2	3	3	3
CO4	3	3	3	2	3		2	2	3	3	2	3	3	3	3
CO5	3	3	3	2	3		2	2	3	3	2	3	3	3	3
Average	3	3	3	2.8	2.8	0.5	1.3	2.8	2.5	2.8	2.3	2.8	3	3	2.2

<table>
<tr><td colspan="3">Course Content:</td></tr>
<tr><td colspan="2">L (Hours/Week)</td><td>T (Hours/Week)</td><td>P (Hours/Week)</td><td>Total Hour/Week</td></tr>
<tr><td colspan="2">3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Unit</td><td colspan="4">Content</td></tr>
<tr><td>1</td><td colspan="4">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 (Understanding); Understand the use of technology and social media as platforms for disaster communication, including their benefits and limitations C2 (Understanding); Understand the roles and responsibilities of stakeholders in disaster management, including government agencies, NGOs, and local communities C2 (Understanding); Analyze the characteristics and impacts of different types of disasters on individuals, communities, and infrastructure C4 (Analysis); Apply the multi-hazard approach to assess the combined risks and interactions between different hazards C3 (Application); Apply vulnerability assessment and mapping methods to identify and prioritize areas at higher risk C3 (Application); Analyze the strengths and limitations of different risk perception and assessment techniques C4 (Analysis)</td></tr>
<tr><td>2</td><td colspan="4">Understand the purpose and structure of emergency management plans and frameworks C2 (Understanding); Comprehend the importance of community preparedness and resilience in enhancing disaster response C2 (Understanding); Comprehend the objectives and processes of search and rescue operations in emergency situations C2 (Understanding); Apply the principles and components of incident command systems to establish effective command structures in emergency situations C3 (Application); Evaluate the impact of disaster education and public awareness programs in promoting a culture of preparedness C5 (Evaluate);</td></tr>
<tr><td>3</td><td colspan="4">Understand the purpose and methodologies of post-disaster damage assessment and needs analysis C2 (Understanding); Analyze the strengths and weaknesses of recovery planning and resource allocation strategies in addressing the diverse needs of affected populations C4 (Analysis); Analyze the impact of psychosocial support in facilitating the emotional and psychological recovery of individuals and communities C4 (Analysis); Evaluate the efficiency and effectiveness of infrastructure restoration and rebuilding efforts in restoring essential services and enhancing resilience C5 (Evaluate)</td></tr>
<tr><td>4</td><td colspan="4">Understand the concept of climate change and its influence on the frequency and intensity of natural hazards, and subsequently, disaster risk C2 (Understanding); Utilize technological advancements in disaster management to improve response and recovery processes C3 (Application); Analyze the future challenges and opportunities in disaster control and management to anticipate and plan for emerging trends and needs C4 (Analysis)</td></tr>
</table>

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:	
	<u>Text Books</u> R Subramanian, Disaster Management; Vikas Publishing, ISBN : 9789352718702, year : 2018 **<u>References</u>** 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
Course Code	130105121
Course Title	**Earth and Environment**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
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**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3			3	2	3	2	3	3	1	1
CO2	3	3	3	3	2	2	3	3	3	3	3	3	3	1	1
CO3	3	3	3	3	3			3	2	2	2	2	3	2	1
CO4	3	3	3	2	3		2	2	3	3	2	3	3	2	1
CO5	3	3	3	2	3		2	2	3	3	2	3	3	1	1
Average	3	3	3	2.8	2.8	0.5	1.3	2.8	2.5	2.8	2.3	2.8	3	1.4	1

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 (Remember); composition and characteristics of the Biosphere and the Atmosphere C2 (Understanding); Analyze the complex factors contributing to climate change and their implications for global and regional climates C3 (Application); analyze the processes and consequences of geologic, tectonic, and biogeochemical cycles on the Earth's structure and surface C4 (Analysis); Assess the significance of human actions in contributing to environmental changes and climate change C5 (Evaluate)
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 (Remember); Understand the significance of natural resources for human well-being and economic development C2 (Understanding); Apply sustainable practices in fisheries and forestry to ensure the long-term viability of these resources C3 (Application); Evaluate the effectiveness of conservation strategies in maintaining the sustainability of renewable biological resources C4 (Analysis); Evaluate the environmental impacts of resource use and identify strategies for minimizing pollution and ensuring resource sustainability C4 (Analysis); Assess the impact of recycling efforts on reducing resource depletion and promoting sustainable resource use C5 (Evaluate); investigate conservation strategies that address scarcity challenges and promote the sustainable use of resources C6 (Create)
3	Understand the concept of energy consumption and its impact on the environment C2 (Understanding); Analyze the economic, social, and environmental implications of different energy resources C4 (Analysis); Evaluate the efficiency and sustainability of energy consumption patterns in various sectors C4 (Analysis); Evaluate the potential of future renewable energy alternatives in meeting energy demands and reducing environmental impacts C5 (Evaluate); Analyze the relationship between climate change and energy C4 (Analysis); Assess the feasibility and potential benefits of future renewable energy alternatives in reducing reliance on fossil fuels C5 (Evaluate)
4	Concept of Environmental impact assessments, social equity, Climate change adaptation and resilience C2 (Understanding); Analysis of real-world environmental issues and case studies C4 (Analysis); Assess the emerging trends in earth and environmental science C5 (Evaluate), Assess the role of individuals and communities in promoting sustainable practices C5 (Evaluate); Evaluate the technical advancement role in environmental conservation C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	29
Practical	--
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	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:

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.

SPECIALIZATION

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105122
Course Title	**Introduction to AI and ML**
Academic Year	III
Semester	V
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities

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

CO1	Possess the skill for representing knowledge using the appropriate technique for a given problem.
CO2	Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.
CO3	Understand the concepts of computational intelligence like machine learning.
CO4	Understand the Neural Networks and its usage in machine learning application.

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

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P01 2**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

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

Unit	**Content**	**Competencies**
1	Explain Problem-Solving by Search-I. (C2, Comprehension), Define Intelligent Agents Problem Solving by Search –II: Problem-Solving Agents, Searching for Solutions. (C1: Knowledge), Recall the purpose	

	and importance of Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search. (C1: Knowledge), Explain Informed (Heuristic) Search Strategies: Greedy best-first search, A search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environment (C2, Comprehension)
2	Analyze the Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm. (C4, Analysis), Analyze the Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks (C4, Analysis), Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms. (C6, Evaluation)
3	Generalize the concept of Bayesian learning –Bayes theorem and concept learning (C5, Synthesis), Explain the Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm (C2, Comprehension), Describe the Computational learning theory, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning (C2, Comprehension), Recall the Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning (C1, Knowledge)
4	Explain the principles and mechanisms of Genetic Algorithms an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms. (C2: Comprehension), Analyze the Learning Sets of Rules, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution. (C4: Analysis), Describe Combining Inductive and Analytical Learning, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis (C1, Knowledge)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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**
Assignment / Presentation	✓	✓	✓	✓	✓	✓
Unit test	✓	✓	✓	✓	✓	✓
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:

Text Books

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.
2. Machine Learning – Tom M. Mitchell, - MGH

Reference books:-

1. Artificial Intelligence, 3rd Edn, E. Rich and K.Knight (TMH)

	2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education. 3. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130105123
Course Title	**Introduction to AI and ML Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

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

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

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

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P01 2**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

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

Experiment No.	**Content**
1.	The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is

	The probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%) (C1, Knowledge)
2.	Extract the data from database using python. (C1, Knowledge)
3.	Implement k-nearest neighbours classification using python. (C6, Evaluation)
4.	Implement linear regression using python. (C6: Evaluation)
5.	Implement Naïve Bayes theorem to classify the English text. (C6, Evaluation)
6.	Implement an algorithm to demonstrate the significance of genetic algorithm. (C6, Evaluation)
7.	Implement the finite words classification system using Back-propagation algorithm. (C6: Evaluation)
8.	Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k means clustering with 3 means (i.e., 3 centroids) VAR1 VAR2 CLASS 1.713 1.586 0 0.180 1.786 1 0.353 1.240 1 0.940 1.566 0 1.486 0.759 1 1.266 1.106 0 1.540 0.419 1 0.459 1.799 1 0.773 0.186 1 (C1, Knowledge)
9.	The following training examples map descriptions of individuals onto high, medium and low credit-worthiness. medium skiing design single twenties no -> high Risk high golf trading married forties yes -> low Risk low speedway transport married thirties yes -> med Risk medium football banking single thirties yes ->low Risk high flying media married fifties yes -> high Risk low football security single twenties no -> medRisk medium golf media single thirties yes -> medRisk medium golf transport married forties yes -> lowRisk high skiing banking single thirties yes -> highRisk low golf unemployed married forties yes -> highRisk Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset? (C1, Knowledge)

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
VIVA	☐	☐	☐	☐	☐	☐
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐
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 - VI

Course Code	Course Title
130106111	Design of Steel Structures-I
130106112	Water Treatment & Supply Systems
130106113	Water Treatment & Supply Systems Lab
130106114	Highway Engineering
130106115	Highway Engineering Lab
130106116	Geo-Technology
130106117	SEC-IV (Civil Engineering Design Lab)
	Quantitative Aptitude & Logical Reasoning (MCNC)
Program Elective-IV Pool (Choose One from the pool)	
130106118	Reinforced Concrete Structures-II
130106119	Construction Safety
130106120	Energy Efficient Structure
130106121	Introduction to Smart Cities
Additional Subjects for Specialization Artificial Intelligence and Data Science	
130106122	Data Mining
130106123	Data Mining Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106111
Course Title	**Design of Steel Structures-I**
Academic Year	III
Semester	VI
Number of Credits	4
Course Prerequisite	NIL
Course Synopsis	Study of BIS Codes i.e. IS: 800-1984, IS: 800-2007 related to design of steel structures. Study of design of different types of connections, simple and built-up beams, laterally supported and unsupported beams. The subject imparts knowledge of design beams and columns under combined stresses. Design simple and built up beams and columns.

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

CO1	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	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	2	1	3	1	2	1	2	3	3	2
CO2	1	2	2	2	1	2	2	3	2	2	2	2	3	3	2
CO3	2	3	3	2	2	3	3	3	3	2	3	2	3	3	2
CO4	1	2	1	2	1	2	1	3	1	2	1	2	3	3	2
Average	1.3	2.3	1.8	2.0	1.3	2.3	1.8	3.0	1.8	2.0	1.8	2.0	3	3	2

Course Content:

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

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

	Analyze the design aspects of eccentric connections, efficiency of joints, and the utilization of high-tension bolts. C4 (Analysis) Evaluate the interplay between the properties of structural steel, rolled steel sections as per IS specifications, and the factor of safety in the design of connections. C5 (Evaluate)
2	Define the compression member in steel structures and its design phenomenon along with the different theories adapted in designing of compression member. C1 (Remember) Understand the concepts of Net Sectional Area, Permissible Stress, and the design principles for axially loaded tension members and members subjected to axial tension and bending. C2 (Understand) Apply the principles of column design, including the modes of failure, buckling failure according to Euler's Theory, effective length, and slenderness ratio. C3 (Application) Analyze the design principles for compression members and built-up compression members, such as laced and battened columns, as well as the design of column splices. C4 (Analysis) Design the compression member. C6 (Create)
3	Define the Tension member in steel structures and its design phenomenon along with the different theories adapted in designing of compression member. C1 (Remember) Understand the introduction to beams, beam types, section classification, lateral stability of beams, lateral torsional buckling of symmetrical sections, design strength of beams (both laterally supported and unsupported). C2 (Understand) Apply the principles of shear strength and deflection, web buckling, and web crippling in beam design. C3 (Application) Analyze the design of slab bases, gusset bases, and grillage foundations, including their connections with columns. C4 (Analysis) Design the tension member. C6 (Create)
4	Understand the concept gantry girders and plate girders, loading considerations, maximum load effects, and the selection and design principles for gantry girders and plate girders. C2 (Understand) Applying the principles of loading considerations, maximum load effects, and selection and design principles to gantry girders and plate girders. C3 (Application) Analyzing the loading conditions and the selection and design principles for gantry girders and plate girders. C4 (Analysis) Design gantry girder and plate girder. C6 (Create)

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:	
	Text Books 1. Design of Steel Structures by N. Subramanian (2012),ISBN No. 978-0-19-567681-5, 8th edition Oxford Publication. **Reference Books** Vajrani V. N., Ratwani M. M. and Mehra H. Design and Analysis of Steel Structures, Oscar Publications. Syal I. C. Design of Steel Structures, Standard Publishers Distributors,

	New Delhi Ramchandra, Non Linear Analysis of Steel Structures, Standard Publishers Distributors. IS: 800-2007 & Steel Table. 4. Design of Steel Structures by Arya and Ajmani, Nem Chand Brothers Roorkee. 5. Ramachandra, Design of Steel structures, Vol. I & Vol. II, Standard Publishers Distributors

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106112
Course Title	**Water Treatment & Supply Systems**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge of this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pre-treatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society along with knowledge of distribution of water and requirement of building plumbing.

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

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

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

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

<table>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Course Content:</td></tr>
<tr><th>L (Hours/Week)</th><th>T (Hours/Week)</th><th>P (Hours/Week)</th><th>Total Hour/Week</th></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

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

	system, distribution reservoirs, water distribution networks, analysis of distribution networks, layout considerations, capacity and pressure requirements, leak detection, maintenance, and water supply in buildings and plumbing. C2 (Understand) Apply the principles of distribution system layout, distribution reservoirs, water distribution networks, analysis of distribution networks, layout considerations, capacity and pressure requirements, leak detection, maintenance, and water supply in buildings and plumbing. C3 (Application) Analyzing the efficiency, reliability, and performance of distribution system layouts, distribution reservoirs, water distribution networks, leak detection techniques, maintenance practices, and plumbing systems. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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. **2.** Feedback between the semester through google forms

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

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106113
Course Title	**Water Treatment & Supply Systems Lab**
Academic Year	III
Semester	VI
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	The Water Treatment and Supply System Lab offers practical training on various aspects of water treatment and distribution. Students will learn water quality analysis techniques, including testing parameters such as pH, turbidity, and chlorine levels. Students will evaluate system performance through experiments, data analysis, and propose improvements for efficient water supply systems.

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

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

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

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

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

Experiment No.	Content	Competencies
1.	To determine the pH of a given water sample. C5 (Evaluate)	
2.	To determine the total solids, suspended solids, dissolved solids and volatile solids in wastewater. C5 (Evaluate)	
3.	To determine the turbidity and specific conductivity of the given water samples. C5 (Evaluate)	
4.	To determine the Alkalinity of given water sample. C5 (Evaluate)	
5.	To determine total hardness, permanent hardness and temporary hardness for given water sample. C5 (Evaluate)	
6.	To determine amount of sulphates in a given sample. C5 (Evaluate)	
7.	To determine the optimum dosage of coagulant for turbidity removal of a given water sample. C5 (Evaluate)	
8.	Determination of BOD C5 (Evaluate)	
9.	Determination of COD C5 (Evaluate)	
10.	To determine amount of Fluorides in a given sample. C5 (Evaluate)	

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

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

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

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

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

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

Course Content:

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

Unit	**Content**	**Competencies**
1	Understand the concepts related to transportation engineering, including	

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

	traffic loads. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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. **2.** Feedback between the semester through google forms

References:	
	<u>Text Books</u>

	S.K. Khanna, C.E.G. Justo & A. Veeragavan (2014),10th Edition, ISBN No. 978-81-85-240-72-05, Highway Engineering, Nem Chand and Bros **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
Course Code	130106115
Course Title	**Highway Engineering Lab**
Academic Year	III
Semester	VI
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Highway Engineering is a prominent aspect of surface transport. Highway engineering deals with planning, design, construction, operation and maintenance of all types of roads. During the course, the students will learn about the highway related tests on Soil, Bitumen and Aggregate. Students will also get familiar with the test on Modified Binder and modern techniques of highway construction along with use of modern highway construction materials. Course shall also contain design of Highway Engineering.

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

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

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

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

Course Content:

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

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

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

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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**			
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
Course Code	130106116
Course Title	**Geo-Technology**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course delves into advanced topics in soil mechanics, focusing on the behavior and properties of soils under complex loading conditions. Key subjects covered include consolidation, shear strength, stress-strain relationships, and soil dynamics. Students will explore advanced laboratory testing methods and numerical modeling techniques to analyze soil behavior. The course also investigates geotechnical design principles for foundations, retaining walls, and slope stability. Through case studies and practical applications, students will develop a deep understanding of advanced soil mechanics principles and their practical implications in geotechnical engineering projects.

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

CO1	Comprehend and utilize the geotechnical literature to establish the framework for foundation design.
CO2	Plan and implement a site investigation program including subsurface exploration to evaluate soil/structure behavior and to obtain the necessary design parameters.
CO3	Carry out slope stability analysis for various fills and slopes.
CO4	Determine allowable bearing pressures and load carrying capabilities of different foundation systems.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**2**	**2**			**2**			**3**		3	2	2
CO2	**3**	**3**	**2**	**2**	**2**			**2**			**3**		3	2	2
CO3	**3**	**3**	**2**	**2**	**2**			**2**					3	2	2
CO4	**3**	**3**	**3**	**3**	**2**			**2**			**2**		3	2	1
CO5	**3**	**3**	**3**	**3**	**2**			**2**			**2**		3	2	1
Average	**3**	**3**	**2.5**	**2.2**	**2**			**2**			**2**		3	2	1.6

Course Content:

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

Unit	Content	Competencies
1	Understand the concepts related to Mohr's-Coulomb theory, Tresca theory, and von Mises theory. Gain knowledge about earth pressure, including the active and passive states of earth pressure and pressure at rest. Understand Rankine's and Coulomb's wedge theory. Learn about earth pressure computation for practical cases. C2 (Understand) Apply the principles of Mohr's-Coulomb theory, Tresca theory, and von Mises theory in analyzing the strength and failure behavior of soils and rocks. Apply the concepts of earth pressure, including the active and passive states of earth pressure and pressure at rest, in analyzing the stability of retaining structures. Apply Rankine's and Coulomb's wedge theory in analyzing slope stability. Apply earth pressure computation methods for practical cases to determine the loads acting on retaining structures and slopes. C3 (Application) Analyze the suitability and limitations of different theories in predicting material behavior and stability. Analyze the factors influencing earth pressure and slope stability. Analyze the accuracy and reliability of earth pressure computation methods. C4 (Analysis)	
2	Understand the concepts related to the failure of finite and infinite slopes. Learn about the Swedish circle method, Friction Circle method, Taylor's stability number, stability curves, factor of safety, slope stability of earth dams, and the introduction to Bishop's method. C2 (Understand) Apply the Swedish circle method, Friction Circle method, Taylor's stability number, and stability curves in analyzing slope stability. Apply the concept of factor of safety in determining slope stability. Apply the principles of slope stability analysis to assess the stability of earth dams. Apply the introductory concepts of Bishop's method in slope stability analysis. C3 (Application) Analyze the suitability and limitations of different methods and concepts in predicting slope stability. Analyze the factors influencing slope stability and the stability of earth dams. Analyze the principles and limitations of Bishop's method. C4 (Analysis)	
3	Understand the concepts related to bearing capacity, minimum depth of foundation, failure theories, Meyerhof's analysis, different equations for bearing capacity, and the effect of the water table on bearing capacity. Learn about the IS code method for computing bearing capacity. Understand shallow foundations, safe bearing capacity, settlement of footings (immediate and time-dependent settlement), and permissible limits. Gain knowledge about deep foundations, classification and selection of piles, static and dynamic formulae for single pile capacity, efficiency and capacity of pile groups, settlement of pile groups, load tests on piles as per BIS codes, and classification and selection of under reamed piles. C2	

	(Understand) Apply the concepts of bearing capacity analysis, including Meyerhof's analysis and IS code methods. Apply the principles of shallow foundation design, including safe bearing capacity and settlement analysis. Apply the principles of deep foundation design, including classification and selection of piles, single pile capacity analysis using static and dynamic formulae, efficiency and capacity analysis of pile groups, settlement analysis of pile groups, and conducting load tests on piles as per BIS codes. Apply the principles of classification and selection of under reamed piles. C3 (Application) Analyze the suitability and limitations of different methods and equations for bearing capacity analysis. Analyze the factors influencing the bearing capacity, such as soil properties and the presence of water. Analyze the factors influencing settlement of footings and the permissible limits. Analyze the factors influencing the classification and selection of piles and under reamed piles. Analyze the accuracy and reliability of load tests on piles for assessing pile performance and capacity. C4 (Analysis)
4	Understand the objective of site investigation in foundation engineering. Learn about the different stages of site investigation, including reconnaissance and detailed site investigation. Gain knowledge about the methods of exploration used in site investigation, including geophysical methods and seismic refraction survey. Understand the concept of depth of exploration, selection of foundation, plate load test, and standard penetration test. C2 (Understand) Apply the concepts of site investigation, including reconnaissance and detailed site investigation, to assess subsurface conditions. Apply different methods of exploration, such as drilling techniques, geophysical methods, and seismic refraction survey, to collect data on soil and rock properties. Apply the concept of depth of exploration to determine the appropriate depth for investigating the subsurface conditions. Apply the principles of selecting the suitable foundation type based on site investigation data. Apply the knowledge of plate load test and standard penetration test to assess soil properties in-situ. C3 (Application) Analyze the importance and objectives of site investigation in foundation engineering. Analyze the strengths and limitations of different methods of exploration and geophysical techniques in collecting subsurface data. Analyze the interpretation of seismic refraction survey data to determine subsurface layering and velocity profiles. Analyze the factors influencing the depth of exploration and its impact on foundation design. Analyze the factors influencing the selection of the appropriate foundation type based on site investigation data. Analyze the principles and procedures of plate load test and standard penetration test and their relevance in foundation design. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
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:

<u>Text Books</u>

1. Dr. K.R. Arora , Soil Mechanics and Foundation Engineering(2011), ISBN No. 81-8014-112-8, Seventh Edition, Standard Publishers

	Distributors, Delhi . **Reference Books** 1. Shashi K. Gulhati&Manoj Datta, Geotechnical Engineering, Tata McGraw Hill Ltd. 2. Donald P Coduto, William A. Kitch, Man-chu Ronald Yeung, Geotechnical Engineering: Principles and Practice, Pearson Education. 3. Joseph E. Bowles, Foundation Analysis and Design, McGraw-Hill, New York. 4. Arun Kr. Jain, & B.C. Punmia, Ashok Kr. Jain, Soil Mechanics and Foundations, Laxmi Publications.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106117
Course Title	**Civil Engineering Design Lab**
Academic Year	III
Semester	VI
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	This lab-based course is designed to familiarize students with the structural analysis and design software, STAAD PRO. The syllabus covers topics such as structural modeling, load calculations, and analysis of various structural elements such as beams, columns, and trusses. Students will learn to apply design codes and standards to ensure structural safety and efficiency. The course emphasizes hands-on experience through practical exercises and projects, allowing students to develop proficiency in using STAAD PRO for structural analysis and design.

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

CO1	Independently carry out research / investigation and development work to solve practical problems.
CO2	Capable to apply the core, multidisciplinary knowledge for understanding the problems in structural engineering and allied fields.
CO3	Identify and analyze the impact of Structural Engineering in development projects and find a suitable solution from number of alternatives.
CO4	Conceptualize and design civil engineering structures considering various socioeconomic factors.

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

COs	PO 1	P O2	PO 3	PO 4	P O5	P O6	P O7	P O8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	2	2	1	2	2	3	1	1	2	3	3	1	2
CO2	1	3	2	1	2	2	1	2	2	3	2	1	3	2	1
CO3	2	3	3	3	3	3	1	2	3	3	1	1	3	2	1
CO4	3	3	2	3	2	3	2	1	1	2	1	1	3	3	2
Average	2.25	3	2.25	2.25	2	2.5	1.5	2	1.75	2.25	1.5	1.5	3	2	1.5

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

0	0	4	4

Experiment No.	Content	Competencies
1.	Introduction to STAAD Pro. Environment C2 (Understand), C3 (Application)	
2.	Model Generation C6 (Create)	
3.	Loading Condition C3 (Application)	
4.	Loading Combination C3 (Application)	
5.	Two-Dimensional Portal frame under vertical and horizontal loads C4 (Analyze)	
6.	Analysis of Simply Supported beam C4 (Analyze)	
7.	Analysis of Cantilever beam C4 (Analyze)	
8.	Analysis of Continuous beam C4 (Analyze)	
9.	Truss Analysis C4 (Analyze)	
10.	Roof Truss Analysis C4 (Analyze)	
11.	Case study C5 (Evaluate)	
12.	Introduction to E Layer C2 (Understand), C3 (Application)	
13.	Single Layer Analysis C4 (Analyze)	
14.	Double Layer Analysis C4 (Analyze)	
15.	Multi-Layer Analysis C4 (Analyze)	
16.	Introduction to IIT PAVE C2 (Understand), C3 (Application)	
17.	Design of Flexible Pavement (Deflection Criteria) C6 (Create)	
18.	Design of Flexible Pavement (Rutting Criteria) C6 (Create)	
19.	Design of Flexible Pavement (Thickness Determination) C6 (Create)	
20.	Introduction to IIT RIGID C2 (Understand), C3 (Application)	
21.	Design of Rigid Pavement (Critical Stress) C6 (Create)	
22.	Design of Rigid Pavement (Slab Thickness) C6 (Create)	
23.	Design of Rigid Pavement (Dowel bar) C6 (Create)	

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	--
Practical	15
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	10
Problem Based Learning (PBL)	25
Case/Project Based Learning (CBL)	10
Revision	--
Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative

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
Course Code	130106118
Course Title	**Reinforced Concrete Structures-II**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Course contains learning of concept of working stress method and limit state method for various reinforced concrete sections. It includes concept of design of one way, two way and circular slabs, short column and long column, axially and eccentrically loaded columns. Students will understand the concept of footings and retaining wall design as well.

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

CO1	Understand the behavior and load-carrying capacity of advanced reinforced concrete structural elements.
CO2	Apply advanced analysis techniques to determine the internal forces and deflections in reinforced concrete structures.
CO3	Design Flat slab, Domes, beams, beams curved in plan, water tanks, bunker, silos, chimney R.C.C structures on their own.
CO4	Use relevant BIS codes related to above mentioned R.C.C structures respectively.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	2	2			2			3		3	2	1
CO2	3	3	2	2	2			2			3		3	2	1
CO3	3	3	2	2	2			2					3	3	2
CO4	3	3	3	3	2			2			2		3	2	1
Average	3	3	2.5	2.25	2			2			2		3	2.25	1.25

Course Content:

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

Unit	Content	Competencies
1	Gain an understanding of the introduction to flat slab and its components. Learn about the design methods of flat slab, including the direct method	

	and equivalent frame method based on IS: 456-2000. Acquire knowledge about handling openings in flat slab and the detailing of reinforcement. C2 (Understanding) Apply the design methods and provisions of IS: 456-2000 to design flat slabs using the direct method and equivalent frame method. Apply the principles and guidelines for handling openings in flat slabs and detailing reinforcement. Apply the design principles and analysis techniques for beams curved in plan, considering different support conditions and torsional effects. C3 (Application) Analyze the advantages and components of flat slab construction. Analyze the differences between the direct method and the equivalent frame method for designing flat slabs. Analyze the considerations and techniques for incorporating openings in flat slabs. Analyze the design and analysis of beams curved in plan, including the determination of torsion factors and required reinforcement. C4 (Analysis)
2	Gain an understanding of the introduction to domes, circular tanks, and rectangular tanks. Learn about the stresses in spherical domes due to static and wind loads, as well as the design principles of RCC spherical domes. Acquire knowledge about the general design requirements for circular tanks according to IS: 3370-II. Understand the different types of joints in water tanks, including flexible joints between the floor and wall and rigid joints between the floor and wall. Learn about the IS code provisions for circular tanks. Familiarize yourself with the approximate and exact methods for the design of rectangular tanks. Understand the principles of design for underground tanks, including the calculation of earth pressure and uplift pressure on the wall and floor. C2 (Understanding) Apply the principles of stress analysis to determine the stresses in spherical domes due to static and wind loads. Apply the design principles specified by IS: 3370-II to meet the general design requirements for circular tanks. Apply the appropriate joint design techniques for water tanks, considering flexible and rigid connections. Apply the relevant provisions and guidelines outlined in IS codes for circular tanks. Apply the approximate and exact methods for the design of rectangular tanks. Apply the principles of earth pressure and uplift pressure to design underground tanks. C3 (Application) Analyze the factors affecting the stresses in spherical domes, including static and wind loads. Analyze the design requirements and considerations for circular tanks according to IS: 3370-II. Analyze the implications and performance of different joint types in water tanks. Analyze the provisions and requirements specified in IS codes for circular tanks. Analyze the differences and limitations of the approximate and exact methods for designing rectangular tanks. Analyze the factors influencing the earth pressure and uplift pressure on the walls and floor of underground tanks. C4 (Analysis) Evaluate the effectiveness of the design of RCC spherical domes based on

	the calculated stresses and load-bearing capacity. Evaluate the compliance of circular tanks with the design requirements specified in IS: 3370-II. Evaluate the performance and suitability of different joint designs in water tanks based on their ability to provide watertightness and structural integrity. Evaluate the conformity of circular tanks with the provisions outlined in relevant IS codes. Evaluate the accuracy and reliability of the approximate and exact methods used in the design of rectangular tanks. Evaluate the stability and structural integrity of underground tanks based on the calculated earth pressure and uplift pressure. C5 (Evaluate) Design of dome and water tank. C6 (Create)
3	Acquire an understanding of the introduction to bunkers, conical hoppers, and pyramidal hoppers. Learn about Janssen's theory and Airy's theory, which are relevant to the design of such structures. C2 (Understanding) Apply Janssen's theory and Airy's theory to analyze the pressure distribution, stresses, and displacements in bunkers, conical hoppers, and pyramidal hoppers. Apply the design principles and guidelines to develop efficient and safe bunker designs. Apply structural analysis techniques to design conical and pyramidal hoppers with appropriate dimensions and angles. C3 (Application) Analyze the behavior of granular materials stored in bunkers, conical hoppers, and pyramidal hoppers using Janssen's theory and Airy's theory. Analyze the pressure distribution, stresses, and displacements to ensure the structural integrity and stability of these structures. Analyze the flow characteristics of the stored material to determine the optimal dimensions and angles for efficient discharge. Analyze the load-bearing capacity and performance of structural elements in bunkers, conical hoppers, and pyramidal hoppers. C4 (Analysis) Evaluate the effectiveness of Janssen's theory and Airy's theory in predicting the pressure distribution, stresses, and displacements in bunkers, conical hoppers, and pyramidal hoppers. Evaluate the compliance of bunker designs with the specified design principles and guidelines. Evaluate the efficiency and reliability of conical and pyramidal hopper designs in facilitating material flow and preventing blockages. C5 (Evaluate) Design of Bunkers and hoppers. C6 (Create)
4	Gain an understanding of the basic concepts of prestressed concrete, its advantages, and the materials required for prestressing. Learn about different systems and methods used in prestressing. Acquire knowledge of section analysis, stress concept, strength concept, load balancing concept, and the effects of loading on tensile stresses in tendons. Understand the factors influencing deflections, calculation of deflections, short-term and long-term deflections, losses of prestress, and estimation of crack width. C2 (Understanding) Apply the concepts of prestressed concrete to analyze and design prestressed members. Apply different systems and methods of prestressing

	based on project requirements. Apply section analysis techniques to determine the stress distribution and structural behavior. Apply load balancing techniques to optimize the design and reduce tensile stresses. Apply deflection calculations and consider factors influencing deflections in the design process. Apply methods to estimate crack widths and ensure structural durability. C3 (Application) Analyze the behavior of prestressed concrete members under applied loads and prestressing forces. Analyze stress distribution, strength capacity, and load balancing in prestressed sections. Analyze the effects of loading on tensile stresses in tendons. Analyze the influence of tendon profiles on deflections. Analyze the factors influencing deflections and calculate short-term and long-term deflections. Analyze the losses of prestress and their impact on the structural response. Analyze crack widths and assess their implications for structural durability. C4 (Analysis) Evaluate the effectiveness of prestressing concepts, systems, and methods in enhancing the performance of concrete structures. Evaluate the compliance of prestressed concrete designs with relevant codes and standards. Evaluate the accuracy of deflection calculations and crack width estimations. Evaluate the safety, efficiency, and durability of prestressed concrete members. C5 (Evaluate)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	<u>Text Books</u> R.C.C Designs by B.C. Punmia and A.K. Jain, Laxmi Publication. **<u>Reference Books</u>** 1. Design of Reinforced Concrete Structures, P.Dayaratnam, Oxford& IBH Publication New Delhi.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106119
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	PO 10	PO 11	P0 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2			2			3		3	2	3
CO2	3	3	2	2	2			2			3		3	2	2
CO3	3	3	2	2	2			2					3	2	2
CO4	3	3	3	3	2			2			2		3	3	3
CO5	3	3	3	3	2			2			2		3	3	3
Avera	3	3	2.5	2.2	2			2			2		3	2.4	2.6

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

Unit	**Content**	**Competencies**
1	Define the terms related to construction safety and risk assessment. C1(Remember) Understand the importance of construction safety and its impact on the well-being of workers and the overall project. Familiarize yourself with legal and regulatory requirements governing construction safety. Gain knowledge about safety culture and leadership, recognizing their influence on creating a safe working environment. Understand the roles and responsibilities of key stakeholders in promoting construction safety. Acquire knowledge of the fundamentals of occupational safety and health, including the principles and practices that ensure a safe workplace. Learn about hazard identification and risk assessment techniques. Understand the importance of safety training and education in preventing accidents and injuries. Learn about different types of personal protective equipment (PPE) and their proper use in construction settings. C2 (Understanding) Apply knowledge of legal and regulatory requirements to ensure compliance with safety standards. Apply principles of safety culture and leadership to foster a safe working environment. Apply hazard identification and risk assessment techniques to mitigate risks. Apply safety training and education to promote safe work practices. Apply knowledge of PPE selection and use to ensure worker safety. C3 (Application)	
2	Understand the various construction site hazards and the principles of risk management. Familiarize yourself with safety planning and hazard control strategies in the construction industry. Learn about emergency preparedness and response planning to mitigate potential risks. Acquire knowledge about permit-to-work systems and their importance in ensuring safe work practices. Understand the fall hazards associated with construction activities and the preventive measures to mitigate them. Gain knowledge about different types of scaffolding, their inspection requirements, and safe usage practices. Learn about personal fall arrest systems and their role in protecting workers. Understand the design considerations for safe working at heights in construction. C2 (Understanding). Apply knowledge of construction site hazards to identify and assess risks on construction sites. Apply safety planning and hazard control strategies to develop effective safety plans for construction projects. Apply principles of emergency preparedness and response planning to	

	create emergency protocols and procedures. Apply permit-to-work systems to control hazardous work activities. Apply fall prevention measures and safe usage practices for scaffolding and working at heights. Apply design considerations for safe working at heights in construction projects. C3 (Application) Analyze construction site hazards and evaluate their potential risks. Analyze safety plans and hazard control strategies for their effectiveness in mitigating risks. Analyze emergency preparedness plans and response procedures for their adequacy in handling potential emergencies. C4 (Analysis)
3	Gain knowledge about electrical hazards and the necessary precautions to prevent accidents and injuries. Understand lockout/tagout procedures to ensure the safe isolation of electrical systems during maintenance and repair. Learn about grounding and bonding requirements to prevent electrical shocks and fires. Acquire knowledge about the safe use of electrical tools and equipment to minimize electrical hazards. Familiarize yourself with excavation hazards and the importance of protective systems. Understand soil classification and stability analysis for assessing excavation safety. Learn about sloping, benching, and shoring techniques for excavation support. Understand confined space entry procedures to ensure worker safety. C2 (Understanding) Apply knowledge of electrical hazards and precautions to identify and mitigate electrical risks in the workplace. Apply lockout/tagout procedures to isolate and secure energy sources during maintenance or repair work. Apply grounding and bonding requirements to ensure electrical safety in various work environments. C3 (Application) Analyze excavation sites and identify hazards that may require protective systems. Analyze soil classification and stability data to evaluate excavation stability. Analyze confined spaces for potential hazards and develop appropriate entry procedures. C4 (Analysis)
4	Gain the understanding about the identification and handling of hazardous materials commonly encountered in construction. Understand the importance of chemical labelling and Safety Data Sheets (SDS) in providing essential safety information. Learn safe practices for the storage and disposal of hazardous substances. Understand the importance of effective communication in conveying hazards and safety information. Gain knowledge about safe operation practices for construction machinery. Learn about equipment inspection and maintenance procedures. Understand crane safety principles and proper rigging practices. Learn about traffic control measures and vehicle safety on construction sites. Acquire knowledge about sustainable construction practices and their relation to safety considerations. Understand the importance of psychological and mental health in construction safety. C2 (Understanding) Apply knowledge of hazardous material identification to assess and

	handle potential risks on construction sites. Apply understanding of chemical labelling and SDS to interpret safety information and take appropriate precautions. Apply safe storage and disposal practices for hazardous substances. Apply effective communication strategies to convey hazards and safety information to workers. C3 (Application) Analyze traffic patterns and vehicle operations on construction sites to develop effective traffic control strategies. Analyze sustainable construction practices to evaluate their impact on worker safety. Analyze psychological and mental health factors to identify potential stressors and implement appropriate support systems. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:						
	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
Course Code	130106120
Course Title	**Energy Efficient Structure**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	The course "Energy Efficient Structures" focuses on the principles, techniques, and technologies used in the design and construction of energy-efficient buildings. It explores strategies to reduce energy consumption, improve thermal comfort, and promote sustainability in the built environment. Students will learn about energy-efficient building envelope design, HVAC systems, lighting design, renewable energy integration, and energy modelling techniques. The course emphasizes the importance of energy conservation and equips students with the knowledge and skills to design and evaluate energy-efficient structures.

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

CO1	Understand the importance of construction safety and its impact on project success.
CO2	Identify and assess safety hazards in construction sites.
CO3	Apply risk management techniques to mitigate safety risks in construction projects.
CO4	Develop safety plans and procedures for construction sites.
CO5	Implement appropriate hazard control measures and safety protocols.

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

COs	**P O1**	**P O2**	**P O3**	**P O4**	**P O5**	**P O6**	**P O7**	**P O8**	**P O9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	3	2	2			2			3		3	3	2
CO2	3	3	2	2	2			2			3		3	3	2
CO3	3	3	2	2	2			2					3	3	2
CO4	3	3	3	3	2			2			2		3	3	2
CO5	3	3	3	3	2			2			2		3	3	2
Average	3	3	2.5	2.2	2			2			2		3	3	2

Course Content:

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

Unit	Content	Competencies
1	Acquire knowledge about the importance of energy efficiency in the built environment and its impact on sustainability. Understand energy codes, standards, and certifications that regulate energy efficiency in buildings. Learn about life cycle assessment and embodied energy to evaluate the environmental impact of building materials and construction processes. Gain knowledge about the principles of sustainable building design and their role in achieving energy efficiency. Understand the concept of energy audits and benchmarking to assess and improve building energy performance. Learn about data collection and analysis techniques for evaluating energy usage in buildings. Acquire knowledge about energy monitoring and metering techniques to track and manage energy consumption. Understand energy performance indicators and metrics used to measure and compare the energy efficiency of buildings. C2 (Understanding) Apply life cycle assessment and embodied energy concepts in evaluating the environmental impact of building materials and processes. Apply life cycle assessment and embodied energy concepts in evaluating the environmental impact of building materials and processes. C3 (Application) Analyze the impact of energy efficiency in the built environment on energy consumption, cost savings, and environmental sustainability. Analyze energy codes, standards, and certifications to ensure compliance and promote energy-efficient design practices. Analyze energy performance indicators and metrics to evaluate the energy efficiency of buildings and compare their performance. C4 (Analysis)	
2	Acquire knowledge about heat transfer mechanisms in buildings, including conduction, convection, and radiation. Understand the properties and characteristics of insulation materials and techniques used to reduce heat transfer. Learn about fenestration design and selection, including windows and doors, to optimize energy efficiency. Gain knowledge about air sealing and thermal bridging mitigation techniques to minimize heat loss and improve insulation. Understand different types of HVAC systems and their energy efficiency characteristics. Learn about load calculations and system sizing to ensure proper HVAC design. Acquire knowledge about energy-efficient equipment selection, including efficient heating and cooling units. Understand control strategies for optimizing HVAC performance and energy efficiency. C2 (Understanding) Apply air sealing and thermal bridging mitigation techniques to enhance building envelope efficiency. Apply knowledge of different HVAC systems and their energy efficiency characteristics to select the most suitable system for a building. Apply load calculations and system sizing methods to properly design HVAC systems. C3 (Application)	

3	Acquire knowledge about the principles of daylighting and its benefits, including improved visual comfort, energy savings, and human health and well-being. Understand design strategies for maximizing natural light in buildings, such as building orientation, window placement, and shading devices. Learn about energy-efficient lighting technologies and fixtures, including LED lighting and high-efficiency lamps. Gain knowledge about lighting control systems and daylight harvesting techniques that optimize the use of natural light. Understand solar energy systems for electricity generation and heating, wind energy systems, and geothermal systems. Learn about the integration of renewable energy technologies into building design. Acquire knowledge about economic and environmental considerations associated with the implementation of renewable energy technologies in buildings. C1 (Remember), C2 (Understanding) Apply knowledge of energy-efficient lighting technologies and fixtures to select appropriate lighting solutions for energy savings. Apply lighting control systems and daylight harvesting techniques to integrate natural light and artificial lighting effectively. Apply knowledge of solar energy systems, wind energy systems, and geothermal systems to incorporate renewable energy sources into building designs. C3 (Application) Analyze building designs to identify opportunities for maximizing natural light. Analyze the energy efficiency and performance of different lighting technologies and fixtures.Analyze the feasibility and potential benefits of solar energy systems, wind energy systems, and geothermal systems in specific building projects. C4 (Analysis)
4	Acquire knowledge about retrofit strategies for improving energy efficiency in existing buildings, including building envelope upgrades and retrofit techniques. Understand different options for retrofitting HVAC systems to enhance energy performance. Learn from case studies of successful building retrofit projects that have achieved significant energy savings. Familiarize yourself with green building certification systems such as LEED and BREEAM. Gain knowledge about water conservation strategies and technologies to reduce water usage in buildings. Understand the importance of indoor environmental quality and occupant comfort in sustainable building design. Learn about life cycle costing and sustainable materials selection to make informed decisions about building materials and systems. C1 (Remember), C2 (Understanding) Apply green building certification systems' criteria and standards in the evaluation and certification of sustainable retrofit projects. Apply water conservation strategies and technologies to retrofit projects for efficient water management. Apply principles of indoor environmental quality to enhance occupant comfort and well-being in retrofit designs. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**

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

Assessment Methods:

Formative	Summative
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:	
	Text Books Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press **Reference Books**

	1. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press 2. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106121
Course Title	**Introduction to Smart Cities**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	The course "Introduction to Smart Cities" provides students with a comprehensive understanding of the concept of smart cities and their potential to address urban challenges through the integration of technology, data, and sustainable practices. The course explores various aspects of smart cities, including smart governance, infrastructure, mobility, energy, and sustainability. Students will learn about the key components of smart cities, emerging technologies and innovations, data analytics, and citizen engagement. The course aims to equip students with the knowledge and skills to contribute to the development and implementation of smart city initiatives.

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

CO1	Understand the concept and evolution of smart cities.
CO2	Identify the key components and systems that make up smart cities.
CO3	Analyze the benefits and challenges of implementing smart city technologies and solutions.
CO4	Explain the role of technology, data, and connectivity in smart city development.
CO5	Understand the principles of urban planning and design in the context of smart cities.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	2	2			2			3		3	2	1
CO2	3	3	2	2	2			2			3		3	2	1
CO3	3	3	2	2	2			2					3	2	1
CO4	3	3	3	3	2			2			2		3	2	
CO5	3	3	3	3	2			2			2		3	2	
Average	3	3	2.5	2.2	2			2			2		3	2	1

<table>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Course Content:</td></tr>
<tr><th colspan="2">L (Hours/Week)</th><th>T (Hours/Week)</th><th>P (Hours/Week)</th><th colspan="2">Total Hour/Week</th></tr>
<tr><td colspan="2">3</td><td>0</td><td>0</td><td colspan="2">3</td></tr>
<tr><th>Unit</th><th colspan="4">Content</th><th>Competencies</th></tr>
<tr><td>1</td><td colspan="5">Acquire knowledge about smart cities, including their definition and characteristics. Understand the evolution and global trends in smart city development, including the technologies and innovations driving their growth. Learn about the benefits that smart cities can bring, as well as the challenges they may face. Familiarize yourself with smart city frameworks and models that provide a structured approach to their planning and implementation. Understand the concepts of digital governance and e-government services in the context of smart cities. Gain knowledge about open data and transparency practices in smart cities. Learn about citizen participation and co-creation approaches that involve residents in smart city initiatives. Understand the importance of privacy and data security considerations in the implementation of smart city projects. C1 (Remember), C2 (Understanding)
Apply smart city frameworks and models to develop comprehensive plans for smart city initiatives. Apply digital governance practices and e-government services to improve public service delivery and citizen engagement in smart city projects. Apply open data principles to make data available for analysis and innovation. Apply citizen participation and co-creation strategies to involve residents in smart city decision-making processes. Apply privacy and data security measures to protect personal information in smart city operations. C3 (Application)</td></tr>
<tr><td>2</td><td colspan="5">Acquire knowledge about intelligent transportation systems (ITS) and their role in smart cities. Understand the concept of smart buildings and infrastructure and how they contribute to sustainability. Learn about water and waste management strategies in smart cities. Familiarize yourself with sustainable urban planning and design principles. Gain knowledge about connected and autonomous vehicles (CAVs) and their integration into transportation systems. Learn about multi-modal transportation solutions that promote efficient and sustainable mobility. Understand the importance of traffic management and congestion reduction in smart cities. C1 (Remember), C2 (Understanding)
Apply intelligent transportation system (ITS) technologies to design and implement transportation solutions in smart cities. Apply smart building and infrastructure concepts to enhance energy efficiency and automation in building design and operation. Apply water and waste management strategies to promote sustainable resource use and waste reduction in urban areas. Apply sustainable urban planning and design principles to create environmentally friendly and livable cities. Apply connected and autonomous vehicle (CAV) technologies to develop efficient and safe</td></tr>
</table>

	transportation systems. Apply multi-modal transportation solutions to improve accessibility and mobility in urban areas. Apply traffic management strategies to reduce congestion and enhance traffic flow. C3 (Application)
3	Acquire knowledge about energy-efficient systems and their integration with renewable energy sources. Understand the concept of smart grids and their role in energy management. Learn about demand response strategies and energy conservation techniques. Familiarize yourself with sustainable urban energy planning principles. Gain knowledge about the Internet of Things (IoT) and sensor networks in the context of smart cities. Learn about big data analytics and machine learning applications in urban energy systems. Understand the role of artificial intelligence (AI) and predictive analytics in optimizing energy efficiency. Learn about blockchain technology and its potential applications in smart city energy systems. C1 (Remember), C2 (Understanding) Apply knowledge of energy-efficient systems and renewable energy integration to design and implement sustainable energy solutions in smart cities. Apply smart grid concepts to optimize energy distribution and management. Apply demand response strategies and energy conservation techniques in real-world scenarios. Apply sustainable urban energy planning principles to develop energy-efficient urban development plans. Apply IoT and sensor networks to monitor and control energy systems. Apply big data analytics and machine learning algorithms to analyze energy data and optimize energy consumption. Apply AI and predictive analytics to automate energy management processes. Apply blockchain technology in energy transactions and decentralized energy systems. C3 (Application)
4	Acquire knowledge about the relationship between sustainable development goals and smart cities. Understand the concepts of climate change adaptation and mitigation and their relevance to smart city development. Learn about resilience planning and disaster management strategies in the context of smart cities. Familiarize yourself with the principles of circular economy and waste management in urban environments. Analyze successful smart city projects and their impact on sustainability. Explore international comparisons and benchmarking to understand global trends in smart city development. Understand the social and ethical considerations associated with smart city initiatives. Gain knowledge about the economic and policy challenges involved in implementing smart city projects. Explore future directions and opportunities for the development of smart cities. C1 (Remember), C2 (Understanding) Apply the knowledge of sustainable development goals to design smart city projects that align with the SDGs. Apply climate change adaptation and mitigation strategies to develop resilient smart city plans. Apply circular economy principles to design waste management systems

	within smart cities. Apply the analysis of successful smart city projects to inform the design and implementation of new projects. Apply international comparisons and benchmarking to identify best practices for smart city development. Apply social and ethical considerations in the design and implementation of smart city technologies. Apply economic and policy frameworks to address challenges and support the implementation of smart city projects. Apply future-oriented thinking to identify opportunities and innovative approaches for smart city development. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	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

SPECIALIZATION

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106122
Course Title	**Data Mining**
Academic Year	III
Semester	VI
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Here students will be exposed to multiple techniques of understanding and analyzing the data from a mathematical point of view. In addition, they will also use multiple predictive models to analyze the future trend. This will be done in a purely statistical manner.

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

CO1	Understand pattern discovery, clustering, text retrieval, text mining and analytics, and data visualization.
CO2	Illustrate data mining techniques for both structured and unstructured data.
CO3	Learn to carry out exploratory data analysis to gain insights and prepare data for predictive modelling, an essential skill valued in the business.
CO4	Understand the concept of Regression techniques.

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P01 2	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

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

Unit	Content	Competencies
1	Explain definition, traditional and modern approaches, functionality, major issues in Data mining. (C2, Comprehension), Discuss Knowledge data discovery process: Data, attribute types, properties, Discrete and continuous attribute, dataset types, data quality (C2, Comprehension),	

	Measure Data pre-processing: Aggregation, sampling, dimensionality reduction, subset selection, creation, discretization, binarization, attribute transformation, correlation (C6, Evaluation), Explain the following concepts in Association rule mining: Mining task, frequent itemset, apriori algorithm, rule generation. (C2, Comprehension)
2	Explain Classification definition, classification task (C1, Remember), Categorize Classification techniques: Decision tree, rule-based, memory-based reasoning, artificial neural networks, naïve bayes, support vector machine (C3, Application), Discuss Clustering algorithms types: k-means, single linkage, complete linkage, DBSCAN, clustering validation; Dimensionality reduction. (C2, Comprehension)
3	Describe Exploratory data analysis for predictive modelling. (C2:, Comprehension), explain modelling techniques for prediction of continuous and discrete outcomes (C2, Comprehension), Explain graphs to explore and display datasets, fundamental concepts of predictive modelling. (C2, Comprehension)
4	Outline the Regression techniques: linear, multivariate, non-linear; Cross-validation, model selection, overfitting. (C1, Knowledge), Compare design of predictive models using XLMiner tools; Logistic regression of binary variables, cross validation and confusion matrix, cost sensitive classification, and ROC curves. (C3: Application), Explain Implementation of trees and other advanced predictive models by using the software tool XLMiner. (C2, Comprehension)

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	4
Problem Based Learning (PBL)	6
Case/Project Based Learning (CBL)	10
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**
Assignment / Presentation	✓	✓	✓	✓	✓	✓
Unit test	✓	✓	✓	✓	✓	✓
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)
	1. Larose and Larose, Data Mining and Predictive Analytics "Wiley Series on Methods and Applications in Data Mining" (1 ed.), Wiley, 2016. ISBN 978- 8126559138. 2. Bruce Ratner, Statistical and Machine-Learning Data Mining: Techniques for Better Predictive Modeling and Analysis (3 ed.), Chapman and Hall/CRC, 2017. ISBN 978-1498797603.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130106123
Course Title	**Data Mining Lab**
Academic Year	III
Semester	VI
Number of Credits	1
Course Prerequisite	NIL
Course Synopsis	Here students will be exposed to multiple techniques of understanding and analyzing the data from a mathematical point of view. In addition, they will also use multiple predictive models to analyze the future trend. This will be done in a purely statistical manner.

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

CO1	Ability to add mining algorithms as a component to the existing tools.
CO2	Demonstrate the classification, clustering and etc. in large data sets.
CO3	Ability to apply mining techniques for realistic data.
CO4	Ability to apply mining techniques for WEKA Tool.

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P01 2	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

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

Experiment No.	Content
1.	Installation of WEKA Tool. (C1, Knowledge)
2.	Creating new Arff File. (C5, Synthesis)
3.	Data Processing Techniques on Data set. (C1, Knowledge)
4.	Data cube construction – OLAP operations. (C1, Knowledge)
5.	Implementation of Apriori algorithm. (C3, Application)
6.	Implementation of FP- Growth algorithm. (C3, Application)
7.	Implementation of Decision Tree Induction. (C3, Application)
8.	Calculating Information gains measures. (C3, Application)
9.	Classification of data using Bayesian approach. (C3, Application)

10.	Implementation of K-means algorithm. (C3, Application)

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**
VIVA	✓	✓	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓	✓	✓
Demonstration	✓	✓	✓	✓	✓	✓
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

References:	1. Larose and Larose, Data Mining and Predictive Analytics "Wiley Series on Methods and Applications in Data Mining" (1 ed.), Wiley, 2016. ISBN 978- 8126559138. 2. Bruce Ratner, Statistical and Machine-Learning Data Mining: Techniques for Better Predictive Modeling and Analysis (3 ed.),

	Chapman and Hall/CRC, 2017. ISBN 978-1498797603.

SEMESTER - VII

Course Code	Course Title
130107111	Irrigation Engineering
130107112	Estimation & Costing
130107113	Construction Project Management
130107114	Construction Project Management Lab
130107115	Capstone Project
130107116	Valuation & Costing Lab
130107117	Industrial Training - II
Program Elective-V Pool (Choose One from the pool)	
130107118	Bridge Engineering
130107119	Ground Water Engineering
130107120	Railways, Tunnel and Airport Engineering
130107121	Waste Water Treatment
Additional Subjects for Specialization Artificial Intelligence and Data Science	
130107122	Data Visualization
130107123	Data Visualization Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107111
Course Title	**Irrigation Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	In this course, the students will know the importance of irrigation system in India and water requirement of crops. They will also know the hydraulic design of various irrigation structures such as weir, barrage, cross drainage works, dams, silt ejector and excluder, earth dam, canal falls. They will know the various components of head works and head regulator.

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

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

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

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

Course Content:

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

Unit	Content	Competencies
1	Acquire knowledge about the irrigation requirements in India, including the factors that influence irrigation decisions. Understand the scope of irrigation and its importance in agricultural practices. Learn about soil moisture and its relationship with plant growth. Familiarize yourself with	

	crop water requirements and the factors that affect them. Gain knowledge about irrigation scheduling techniques. Understand the concept of irrigation efficiencies and how they impact water use. Learn about the duty-delta-base period concept and the relationship between these parameters. Explore surface and subsurface irrigation methods and their applications. Understand the importance of irrigation water quality and its impact on crop productivity. C1 (Remember), C2 (Understanding) Apply knowledge of irrigation requirements in India to design and implement appropriate irrigation strategies for different crops and regions. Apply the understanding of soil moisture and plant growth to optimize irrigation scheduling and water management. Apply knowledge of crop water requirements to estimate and allocate water resources effectively. Apply principles of irrigation efficiencies to enhance water-use efficiency and crop productivity. Apply the duty-delta-base period concept in designing irrigation systems and determining water supply. Apply knowledge of surface and subsurface irrigation methods to select the appropriate irrigation technique for specific soil and crop conditions. Apply knowledge of irrigation water quality to assess and manage water resources for sustainable crop production. C3 (Application)
2	Acquire knowledge about the introduction to diversion headworks and their significance in water resource management. Understand the layout and components of a diversion headwork structure. Learn about Khosla's theory and the concept of a flow net in hydraulic engineering. Gain an understanding of the safe exit gradient concept and its importance in preventing soil erosion. Familiarize yourself with the hydraulic design principles of weirs based on Bligh's theory. Learn about the design of modern barrages using Khosla's theory. Understand the necessity and functioning of silt excluders and silt extractors in water diversion structures. C1 (Remember), C2 (Understanding) Apply knowledge of diversion headwork components to design layouts for specific water diversion projects. Apply Khosla's theory and the concept of flow nets to analyze seepage and hydraulic behavior in diversion headworks. Apply the concept of safe exit gradient to determine appropriate measures for soil erosion prevention. Apply hydraulic design principles based on Bligh's theory to design weirs for efficient water flow control. Apply Khosla's theory to the design of modern barrages for effective water diversion and storage. Apply knowledge of silt excluders and silt extractors to design appropriate systems for sediment removal in diversion headworks. C3 (Application) Evaluate the performance and functionality of weirs and barrages designed based on hydraulic principles. C5 (Evaluate) Design innovative diversion headwork layouts and component arrangements that optimize water diversion efficiency and minimize environmental impacts. C6 (Create)

3	Acquire knowledge about the classification and selection criteria of cross drainage works in hydraulic engineering. Understand the hydraulic design aspects of aqueducts and syphon aqueducts. Learn about the necessity and classification of canal falls. Gain an understanding of the hydraulic design principles of Sarda type and Straight Glacis falls. C1 (Remember), C2 (Understanding) Analyze the classification criteria and selection process of cross drainage works to determine the most suitable structures for different hydraulic scenarios. Analyze the hydraulic design aspects of aqueducts and syphon aqueducts to ensure their functionality and efficiency. Analyze the necessity of canal falls and their classification to optimize water flow control in canal systems. Analyze the hydraulic design principles of Sarda type and Straight Glacis falls to ensure effective energy dissipation and water flow regulation. C4 (Analysis) Design Sarda type and Straight Glacis falls to enhance their hydraulic performance. C6 (Create)
4	Acquire knowledge about the necessity and classification of dams. Understand the factors involved in the selection of a suitable dam site. Learn about the basic concepts and principles of gravity dams, earth dams, spillways, and their hydraulic design. C1 (Remember), C2 (Understanding) Apply knowledge of dam necessity and classification to select an appropriate dam type for specific purposes. Apply site selection criteria to identify suitable locations for dam construction. Apply hydraulic design principles to design gravity dams, earth dams, and spillways. Apply knowledge of seepage control and filter design to ensure the stability and safety of earth dams. C3 (Application) Analyze the necessity of dams and their classification to determine the most suitable dam type for specific applications. Analyze site selection factors to assess the feasibility and suitability of potential dam sites. Analyze the forces acting on gravity dams and evaluate their stability based on the established criteria. C4 (Analysis)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**

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:

Text Books

1. Irrigation Engineering and Hydraulic Structures (2011) 24th edition, ISBN No. 81-7409-047-9, S.K. Garg, Khanna Publications.

Reference books

1. Viessmen, Jr. & Lewis, Introduction to Hydrology, PHI Learning Private Ltd.
2. Agarwal, V.C. Groundwater Hydrology. PHI Learning Private Ltd.
3. Larry W. Mays, Water Resources Engineering. Wiley Publications.
4. Subramanya, K., Engineering Hydrology, Tata McGraw-Hill.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107112
Course Title	**Estimation & Costing**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course provides a comprehensive understanding of estimation and costing principles in construction projects. Topics covered include quantity surveying, cost estimation methods, pricing of materials and labor, and preparation of project budgets. Students will learn how to interpret construction drawings, quantify materials, and calculate project costs. The syllabus also includes an introduction to computer-aided estimation software. Practical exercises and case studies will enhance students' skills in accurate cost estimation and budgeting. By the end of the course, students will be proficient in preparing detailed project estimates and managing costs effectively in construction projects.

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

CO1	Forecast the approximate cost of the projects through preliminary and detailed estimates.
CO2	Analyze the rates of individual items for the preparation of the estimates.
CO3	To record measurements of the finished products for the calculation of length, area, volume for payment purpose.
CO4	Prepare schedule of quantities required to be attached with the tender documents.

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

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

<table>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>L (Hours/Week)</td><td>T (Hours/Week)</td><td>P (Hours/Week)</td><td>Total Hour/Week</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

<table>
<tr><th>Unit</th><th>Content</th><th>Competencies</th></tr>
<tr><td>1</td><td colspan="2">Acquire knowledge about the principles of estimation, including units of measurement and item work. Understand the different types of estimates and the methods used in estimation. Learn about the estimation of materials for various building components, such as walls, foundations, floors, roofs, and R.B (Random Rubble) and R.C.C (Reinforced Cement Concrete) works. Gain knowledge about estimating quantities for plastering, whitewashing, distempering, painting, doors, windows, lump sum items, and canals. C1 (Remember), C2 (Understanding)
Apply knowledge of estimation principles and methods to accurately estimate quantities of materials for different types of construction projects. Apply estimation techniques to calculate material requirements for walls, foundations, floors, roofs, R.B and R.C.C works, plastering, whitewashing, distempering, painting, doors, windows, lump sum items, and canals. C3 (Application)
Prepare the estimate for building and canal. C6 (Create)</td></tr>
<tr><td>2</td><td colspan="2">Acquire knowledge about the necessity of specifications in construction projects. Understand the different types of specifications, including general specifications and detailed specifications for various construction activities. Learn about the specific requirements and standards for bricks, cement, sand, water, lime, reinforcement, and other construction materials. Gain knowledge about detailed specifications for earthwork, cement, concrete, brickwork, flooring, D.P.C (Damp Proof Course), R.C.C (Reinforced Cement Concrete), cement plastering, white and color washing, distempering, and painting. C1 (Remember), C2 (Understanding)
Apply knowledge of specification requirements to select appropriate materials and methods for construction projects. Apply detailed specifications to ensure the correct proportions, techniques, and quality of construction activities. Apply general specifications to maintain consistency and compliance throughout the construction process. C3 (Application)</td></tr>
<tr><td>3</td><td colspan="2">Acquire knowledge about the purpose, importance, and requirements of rate analysis in construction projects. Understand the units of measurement used in rate analysis and the process of preparing rate analysis. Learn about the procedure of rate analysis for various construction items, including earthwork, concrete works, R.C.C works, reinforced brickwork, plastering, painting, and finishing activities such as white washing and distempering. C1 (Remember), C2 (Understanding)
Apply knowledge of rate analysis purpose and requirements to conduct accurate cost estimation for construction projects. Apply the appropriate</td></tr>
</table>

	units of measurement in rate analysis calculations. Apply the procedure of rate analysis to determine the costs of different construction items, including earthwork, concrete works, R.C.C works, reinforced brickwork, plastering, painting, and finishing activities. C3 (Application)
4	Acquire knowledge about the tendering process and the acceptance of tenders in construction projects. Understand the concepts of earnest money, security money, and retention money. Learn about the importance and usage of measurement books and cash books in project management. Gain knowledge about the preparation, examination, and payment of bills, including first and final bills. Understand the significance of administrative sanction and technical sanction in construction projects. C1 (Remember), C2 (Understanding) Apply knowledge of tendering, billing, and valuation concepts to participate in the tendering process and prepare tender documents. Apply the principles of valuation to assess the worth of buildings and determine financial aspects. Apply measurement book and cash book management techniques for accurate recording and payment of bills. Apply the procedures for preparation and examination of bills and processing payments to contractors. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:

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.

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University
NAAC A+

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107113
Course Title	**Construction Project Management**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Understanding the various stages of project, Economic and financial analysis of project, Project selection, Network scheduling, Use of computer programs, Project bid, Project operation

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

CO1	Fundamental of project management
CO2	Describe and understand the project planning and management tools
CO3	Planning and Scheduling of Activity
CO4	Determine minimum total cost in minimum time for updating and rescheduling a project.

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

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

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

Unit	Content	Competencies
1	Acquire knowledge about the foundations of project management and the key components of a project life cycle. Understand the project environment and the factors that influence project selection. Learn about the purpose and components of a project proposal. Gain knowledge about project scope and its importance in project management. C1 (Remember), C2 (Understanding)	

	Apply project management principles and techniques to initiate, plan, execute, and close projects. Apply project selection methods to evaluate and prioritize potential projects. Apply project proposal frameworks to develop comprehensive project proposals. Apply scope management techniques to define and manage project boundaries and deliverables. C3 (Application)
2	Acquire knowledge about the breakdown structure, network scheduling, critical path method (CPM), program evaluation and review technique (PERT), and assumptions in PERT. C1 (Remember), C2 (Understanding) Apply the breakdown structure to organize project deliverables and activities effectively. Apply network scheduling techniques to create project schedules and identify critical paths. Apply the critical path method to analyze project timelines and identify activities that require close monitoring. Apply the PERT technique to estimate project durations and assess project risks. C3 (Application)
3	Acquire knowledge about modeling, time-cost trade-offs, linear programming, network flow formulations, PERT/COST, and accounting in project management. C1 (Remember), C2 (Understanding) Apply modeling techniques to analyze project scenarios and make informed decisions. Apply time-cost trade-offs techniques to optimize project schedules and balance time and cost constraints. Apply linear programming and network flow formulations to solve resource allocation and scheduling problems. Apply PERT/COST techniques to estimate project costs and assess project risks. Apply accounting principles and techniques to track project costs and develop project budgets. C3 (Application)
4	Acquire knowledge about scheduling with limited resources, resource planning, resource allocation, project schedule compression, project scheduling software, precedence diagrams, decision CPM (Critical Path Method), generalized activity networks, and GERT (Graphical Evaluation and Review Technique) in project management. C1 (Remember), C2 (Understanding) Apply scheduling techniques with limited resources to create and manage project schedules. Apply resource planning strategies to allocate resources effectively and optimize resource utilization. Apply project schedule compression techniques to accelerate project timelines while considering resource constraints. Utilize project scheduling software to develop and analyze project schedules. Construct precedence diagrams to depict task dependencies and logical relationships. Apply decision CPM techniques to analyze project scenarios and make informed decisions. Utilize generalized activity networks and GERT to model complex project constraints and uncertainties. C3 (Application)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	**Contact Hours**
Lecture	20

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

Assessment Methods:

Formative	Summative
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:

Text Books

1. Projects: Planning, Analysis, Selection, Implementation & Review, Prasanna Chandra, 5th Ed., 2002.
2. Project Management: A systems approach to planning and controlling, Harold Kerzner, CBS Publisher, New Delhi, 2nd Ed., 2000.

	Reference Books 1. Lock, D., 2003, Project Management, 8th edition, Gower Publishing Limited 2.AMS REALTIME projects http://www.amsrealtime.com/products/project.htm

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107114
Course Title	**Construction Project Management Lab**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	Understanding the various stages of project, Economic and financial analysis of project, Project selection, Network scheduling, Use of computer programs, Project bid, Project operation.

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

CO1	Fundamental of project management
CO2	Describe and understand the project planning and management tools
CO3	Planning and Scheduling of Activity
CO4	Determine minimum total cost in minimum time for updating and rescheduling a project.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3	3									3	2	2
CO2	3	3	3	3	3				3	2	3		3	3	1
CO3	3	3	3	3	3	2							3	3	3
CO4	3	3	3	3		3		2			3		3	2	2
Average	3	3	3	3	1.2	1.6		0.8	0.6	0.4	1.4		3	2.5	2

Course Content:

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

Experiment No.	Content	Competencies
1.	How to start the project on MS Project C2 (Understanding)	
2.	Creating a basic work breakdown structure (WBS) C6 (Create)	
3.	Creating a WBS with Gantt diagram and network diagram C6 (Create)	
4.	Adding details to the WBS C6 (Create)	

5.	Creating a WBS with details C6 (Create)
6.	Adding resources to the WBS C6 (Create)
7.	Creating a WBS with resources C6 (Create)
8.	Assigning Human and Material resources to tasks C6 (Create)
9.	Printing and formatting the project information C6 (Create)
10.	Application of Critical path C3 (Application)
11.	Creation of Custom Reports C6 (Create)
12.	Assigning cost information to a task C6 (Create)
13.	Tracking progress C4 (Analysis)
14.	Case Study 1 C4 (Analysis), C5 (Evaluate)
15.	Case Study 2 C4 (Analysis), C5 (Evaluate)
16.	Case Study 3 C4 (Analysis), C5 (Evaluate)
17.	Case Study 4 C4 (Analysis), C5 (Evaluate)

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**		
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						

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107115
Course Title	**Capstone Project**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	NIL
Course Synopsis	In this course, student will complete the thesis work.

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

CO1	Solve complex structural problems by applying appropriate techniques and tools.
CO2	Exhibit good communication skill to the engineering community and society.
CO3	Demonstrate professional ethics and work culture.

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

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

Course Content:

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

Experiment No.	Content
1.	Identify the problem (C2, Understand), Implement the suitable solution (C3, Apply), Experiments and tests (C4, Analyze), Investigate and develop the solution (C6, Create)

Teaching - Learning Strategies and Contact Hours

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

Others If any:	--
Total Number of Contact Hours	60

Assessment Methods:

Formative	Summative
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	2. Student's Feedback					

Students Feedback is taken through various steps

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

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107116
Course Title	**Valuation & Costing Lab**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	New Age Skills
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	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	3	3	3	3									3	2	1
CO2	3	3	3	3	3				3	2	3		3	2	2
CO3	3	3	3	3	3	2							3	2	2
CO4	3	3	3	3		3		2			3		3	2	2
Average	3	3	3	3	1.2	1.6		0.8	0.6	0.4	1.4		3	2	1.75

Course Content:

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

Experiment No.	Content	Competencies
1.	Use of building estimate spreadsheet C2 (Understand), C3 (Application)	
2.	Estimation of building (long wall and short wall method) using Excel C3 (Application)	
3.	Estimation of building (center line method) using Excel C3 (Application)	
4.	Analysis of rate for concrete work using Excel C4 (Analyze)	

5.	Analysis of rate for brick work using Excel C4 (Analyze)
6.	Analysis of rate for plaster work using Excel C4 (Analyze)
7.	Estimate quantity of reinforcement using Excel C4 (Analyze)
8.	Preparation for approximate estimate for road project using Excel C6 (Create)
9.	Estimating cost of building on plinth area method using Excel C6 (Create)
10.	Case Study 1
11.	Introduction to Valuation Modeling in Excel C2 (Understand), C3 (Application)
12.	Rental method of valuation using excel C3 (Application)
13.	Direct comparison with capital value using excel C3 (Application)
14.	Valuation based on profit using excel C3 (Application)
15.	Valuation based on cost using excel C3 (Application)
16.	Depreciation method of valuation using excel C3 (Application)
17.	Case Study 2
18.	Case Study 3

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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. **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
Course Code	130107118
Course Title	**Bridge Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	Introduction to history of bridge-building, including types of bridges, aesthetics, and materials for modern bridges; Loadings on bridges including standard truck and lane loading, impact loads, longitudinal and centrifugal forces, wind and seismic loads, thermal loads; Serviceability criteria including deflection and fatigue; Design of reinforced concrete bridges, slab bridges, concrete slab with steel stringer bridges, T-beam or plate girder bridges, box girder bridges, and prestressed concrete bridges; Bridge maintenance including inspection and rehabilitation.

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

CO1	Relate different design philosophies of the highway and railway bridges.
CO2	Understand the structural behavior of different components of a reinforced concrete and steel bridge.
CO3	Analyze and design different components of a highway and railway bridge, to meet desired needs within realistic constraints such as economy, environment friendly, safety, viable construction and its sustainability under loads standardized by Indian Road Congress (IRC).
CO4	Use the techniques, skills, and modern engineering tools and software necessary for design and detailing.
CO5	Analyze and interpret the results using analytical tools and further plan, design and detail different bridges using relevant and upcoming BIS standards.

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

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

<table>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Course Content:</td></tr>
<tr><th colspan="2">L (Hours/Week)</th><th>T (Hours/Week)</th><th>P (Hours/Week)</th><th colspan="2">Total Hour/Week</th></tr>
<tr><td colspan="2">3</td><td>0</td><td>0</td><td colspan="2">3</td></tr>
<tr><th>Unit</th><th colspan="4">Content</th><th>Competencies</th></tr>
<tr><td>1</td><td colspan="5">Acquire knowledge about the introduction to bridges, types of bridges, economic span length, types of loading, dead load, live load, impact effect, centrifugal force, wind loads, lateral loads, longitudinal forces, seismic loads, frictional resistance of expansion bearings, secondary stresses, temperature effect, erection forces and effects, width of roadway and footway, and general design requirements for bridges. C1 (Remember), C2 (Understanding)
Apply knowledge of bridge types and their characteristics to select appropriate bridge designs for specific project requirements. Apply principles of economic span length to determine optimal bridge dimensions. Apply knowledge of loading types to analyze and design bridges for various load scenarios. Apply understanding of frictional resistance of expansion bearings to incorporate expansion joints in bridge designs. Apply knowledge of secondary stresses and temperature effects to assess and mitigate potential structural issues in bridge design. Apply considerations for erection forces and effects to plan and execute bridge construction. Apply design requirements to develop bridge designs that meet safety, durability, and performance standards. C3 (Application)</td></tr>
<tr><td>2</td><td colspan="5">Acquire knowledge about the introduction to structural analysis and design, the method of analysis and design, Courbon's theory, and the grillage analogy. C1 (Remember), C2 (Understanding)
Apply the method of analysis and design to analyze and design structural systems. Apply Courbon's theory to assess the behavior and performance of structural elements. Apply the grillage analogy to simplify the analysis of complex structures. C3 (Application)
Design analysis and design frameworks incorporating the method of analysis and design, Courbon's theory, and the grillage analogy for specific structural applications. Develop innovative approaches to structural analysis and design using advanced techniques and methodologies. C6 (Create)</td></tr>
<tr><td>3</td><td colspan="5">Acquire knowledge about the basic principles of prestressed concrete design, general design requirements, mild steel reinforcement in prestressed concrete members, concrete cover, spacing of pre-stressing steel, slender beams, composite sections, propped and unpropped composite sections, two-stage prestressing, shrinking stresses, and general design requirements for road bridges. C1 (Remember), C2 (Understanding)
Apply the basic principles of prestressed concrete design, general design</td></tr>
</table>

	requirements, and specific design considerations to analyze and design prestressed concrete members and road bridges. C3 (Application)
4	Acquire knowledge about harmonic analysis and folded plate theory, grillage analogy, finite strip method, and finite element method (FEM). Understand the sub-structure components of bridges, including bed blocks, piers, abutments, and their design loads. C1 (Remember), C2 (Understanding) Apply the theories of harmonic analysis, folded plate theory, grillage analogy, finite strip method, and finite element method to analyze and design bridge structures. Apply the design principles and requirements to determine the dimensions and loads for piers and abutments. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
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:	
	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
Course Code	130107119
Course Title	**Ground Water Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	NIL
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	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	3	1	2	3	3	1	1	3	2	3
CO2	3	1	1	2	1	2	2	3	1	1	2	3	3	3	3
CO3	2	2	3	1	2	2	1	2	2	3	2	1	3	2	3
CO4	3	1	1	2	3	2	2	3	1	1	2	3	3	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2.5	2.75

Course Content:

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

Unit	Content	Competencies

1	Acquire knowledge about the hydrologic cycle, including its components and processes. Understand the origin and age of groundwater, the classification of groundwater, aquifers, the water table, Darcy's Law, the coefficient of transmissibility and storage, flow rates, and the relevant equations. C1 (Remember), C2 (Understanding) Apply the principles of the hydrologic cycle, groundwater classification, aquifers, the water table, Darcy's Law, and flow rate equations to analyze and interpret groundwater systems. Apply the concepts to solve problems related to groundwater flow and aquifer characteristics. C3 (Application)
2	Acquire knowledge about geophysical methods used in groundwater exploration and characterization. Understand the principles and techniques of radial flow and well flow analysis. Familiarize yourself with the concepts of multiple well systems, characteristic well losses, and various types of wells, including open wells and tube wells. Learn about well depth, well screen design, and the factors influencing head losses through screens. Gain an understanding of gravel packing and formation stabilization techniques. C1 (Remember), C2 (Understanding) Apply geophysical methods to assess groundwater potential and characterize subsurface conditions. Apply radial flow and well flow analysis techniques to interpret pumping test data. Apply knowledge of well types, depth, and screen design to optimize well performance. Apply techniques for gravel packing and formation stabilization in well construction. C3 (Application)
3	Acquire knowledge about key terms and concepts related to groundwater pumping tests. Understand the definitions of static water level, pumping level, drawdown, residual drawdown, and drawdown pumping rate. Familiarize yourself with the use of automatic water level recorders and the principles behind time drawdown analysis and distance drawdown analysis. Learn about Jacob's methods and different pumping test methods. C1 (Remember), C2 (Understanding) Apply knowledge of key terms and concepts to interpret groundwater pumping test data. Apply the use of automatic water level recorders to gather accurate and reliable water level measurements. Apply time drawdown analysis techniques to analyze and interpret drawdown data obtained during pumping tests. Apply distance drawdown analysis methods, including Jacob's analysis, to estimate aquifer parameters based on distance drawdown curves. C3 (Application)
4	Acquire knowledge about various injection methods and monitoring techniques used in ground improvement. Understand the principles and applications of cement lime, lime-fly ash, and chemical stabilization. Learn about deep mixing techniques and their effectiveness in improving soil properties. Gain knowledge about the hydrological equilibrium and its importance in groundwater management. Understand the concept of a rain gauge network and its role in monitoring rainfall. Learn about the

	procedures for conducting infiltration tests and the calculation of groundwater storage capacity and potential. Familiarize yourself with artificial recharge methods and rainwater harvesting techniques. C1 (Remember), C2 (Understanding) Apply knowledge of different injection methods and monitoring techniques to select appropriate ground improvement methods for specific soil conditions. Apply deep mixing techniques to enhance soil properties and improve ground stability. Apply the principles of hydrological equilibrium to assess groundwater resources and develop sustainable water management strategies. Apply the knowledge of rain gauge networks to establish monitoring systems for rainfall data collection. Apply infiltration testing procedures to evaluate soil infiltration capacity and assess groundwater recharge potential. Apply calculations and estimation methods to determine groundwater storage capacity and potential. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	Text Books Raghunath H.M. (2007), Groundwater, Third Edition, ISBN No. 978-81-224-1904-7, New Age **Reference Books** 1.David Keith Todd (2005), Groundwater Hydrology, Third Edition, John Wiley & Sons 2.Abdel-Aziz ismail kashef (2008), Groundwater Engineering, McGraw-Hill International Editions, New york

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107120
Course Title	**Railways, Tunnel and Airport Engineering**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	NIL
Course Synopsis	This course offers a comprehensive understanding of the engineering principles and practices related to railways, tunnels, and airports. It covers topics such as railway alignment and track design, tunneling methods and design considerations, airport planning and design, and runway and terminal construction. Students will gain knowledge of the unique challenges and design criteria for each of these transportation infrastructure components.

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

CO1	Understand the planning and design considerations for railways, tunnels, and airports.
CO2	Analyse and design railway tracks, including alignment, track components, and track systems.
CO3	Apply principles of earthwork and drainage in railway and airport construction.
CO4	Understand different tunnelling methods and design considerations for tunnels.
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	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	3	1	2	3	3	1	1	3	3	3
CO2	3	1	1	2	1	2	2	3	1	1	2	3	3	2	3
CO3	2	2	3	1	2	2	1	2	2	3	2	1	3	2	1
CO4	3	1	1	2	3	2	2	3	1	1	2	3	3	3	1
CO5	3	1	1	2	3	2	2	3	1	1	2	3	3	2	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2

Course Content:

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

Unit	Content	Competencies
1	Acquire knowledge about railway alignment and surveying techniques. Understand the components and geometry of railway tracks. Learn about track design principles and maintenance practices. Familiarize yourself with the classification and types of tunnels. Gain knowledge about tunnel construction methods and the considerations involved in tunnel design. C1 (Remember), C2 (Understanding) Apply knowledge of railway alignment and surveying techniques to determine the optimal alignment for a given railway project. Apply track design principles and standards to design safe and efficient railway tracks. Apply track maintenance techniques to ensure the smooth operation and longevity of railway tracks. Apply knowledge of tunnel construction methods to select the appropriate method for a specific tunnel project. Apply tunnel design considerations to develop safe and functional tunnel designs. C3 (Application)	
2	Acquire knowledge about tunneling methods and their purposes. Understand the factors that influence the choice of excavation techniques for tunnels. Learn about different methods used in soft ground tunneling, hard rock tunneling, shallow tunneling, and deep tunneling. Familiarize yourself with techniques such as cut and cover, cover and cut, pipe jacking, and jacked box excavation. Gain knowledge about muck disposal methods, tunnel support systems, and common problems encountered in tunneling, along with the corresponding remedial measures. C1 (Remember), C2 (Understanding) Apply knowledge of tunneling methods to select appropriate excavation techniques for specific tunnel projects. Apply soft ground tunneling methods to excavate tunnels in cohesive soils. Apply hard rock tunneling techniques to excavate tunnels in rock formations. Apply shallow tunneling methods such as cut and cover, cover and cut, and pipe jacking for tunnel construction in shallow depths. Apply deep tunneling methods to excavate tunnels at significant depths. Apply muck disposal and tunnel support techniques to ensure safe and efficient tunnel construction. Apply remedial measures to address problems encountered in tunneling projects. C3 (Application)	
3	Acquire knowledge about airport master planning, including the development and management of airports. Understand the airside and landside components of an airport and their functions. Learn about the environmental considerations involved in airport planning, such as noise pollution, air quality, and land use. Gain knowledge about runway geometry and the safety considerations associated with airport operations. Familiarize yourself with pavement design principles and the selection of appropriate materials for airport pavements. C1 (Remember), C2 (Understanding) Apply knowledge of airport master planning to develop comprehensive plans for airport development and expansion. Apply understanding of	

	airside and landside components to design efficient layouts and facilities for aircraft operations and passenger services. Apply environmental considerations to incorporate sustainability and minimize the environmental impact of airports. Apply runway geometry principles to design safe and efficient runways. Apply pavement design principles to develop robust and durable airport pavements using suitable materials. C3 (Application)
4	Acquire knowledge about construction techniques for runways, including the materials, processes, and equipment involved in runway construction. Understand the functions and layout of passenger terminals, including the various areas and facilities required for efficient passenger flow. Learn about baggage handling systems, their components, and their role in airport operations. Gain knowledge about terminal building design and architecture, including considerations such as aesthetics, functionality, and passenger comfort. C1 (Remember), C2 (Understanding) Apply knowledge of construction techniques to implement efficient and safe runway construction projects. Apply understanding of passenger terminal functions and layout to design user-friendly and functional terminal buildings. Apply knowledge of baggage handling systems to design efficient and secure baggage handling processes. Apply principles of terminal building design and architecture to create aesthetically pleasing and functional terminal structures. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:

Text Books

1.Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 1998.

2.Driving Horizontal Workings and Tunnel, by Pokorovski, Mir Publishers, 1980.

Reference Books

1.Rangwala, Airport Engineering, Charotar Publishing House, 1996.

2.Oza.H.P. and Oza.G.H., "A course in Docks &Harbour Engineering". Charotar Publishing Co.1976

3.Drilling and Blasting of Rocks, by Carlos L Jimeno, A.A. Balkema/Rotterdam/Brookfield 1995.

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107121
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	**P O1**	**P O2**	**P O3**	**P O4**	**P O5**	**P O6**	**P O7**	**P O8**	**P O9**	**PO 10**	**PO 11**	**P0 12**	**PS O1**	**PS O2**	**PS O3**
CO1	2	2	1	1	1	2	3	1	1	2	3	1	3	2	2
CO2	3	2	3	2	1	1	3	2	3	2	2	2	3	3	2
CO3	2	3	3	3	3	3	1	2	3	3	1	1	3	3	1
CO4	3	3	2	2	1	2	2	3	1	1	2	3	3	2	2
CO5	1	3	2	1	2	2	1	2	2	3	2	1	3	3	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2.8	1.6

Course Content:

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

Unit	Content	Competencies
1	Acquire knowledge about wastewater flow and its characteristics, including the types of wastewaters and their composition. Understand the wastewater collection systems, including the network of pipes and components used for collecting and transporting wastewater. Learn about the estimation and variation of wastewater flows, including factors such as population, water usage patterns, and seasonal variations. Gain knowledge about the problems associated with industrial wastewaters and the need for specialized treatment. Familiarize yourself with sampling protocols for wastewater analysis. Learn about equalization and neutralization processes used to balance and adjust wastewater characteristics. Understand the concepts of proportioning processes and volume and strength reduction techniques. Acquire knowledge about the preliminary, primary, secondary, and tertiary wastewater treatment processes. Learn about the theory and design principles of screens, grit chambers, sedimentation tanks, coagulation, and flocculation processes. C1 (Remember), C2 (Understanding) Apply knowledge of wastewater flow and characteristics to assess and analyze wastewater collection systems. Apply estimation techniques to determine wastewater flows for design and planning purposes. Apply knowledge of industrial wastewater problems to identify appropriate treatment strategies. Apply sampling protocols to collect representative wastewater samples for analysis. Apply equalization and neutralization techniques to balance and adjust wastewater characteristics. Apply proportioning processes to optimize wastewater treatment efficiency. Apply design principles to design and select appropriate screens, grit chambers, sedimentation tanks, and treatment processes. C3 (Application)	
2	Acquire knowledge about physio-chemical and biological treatment strategies for wastewater, including their principles and mechanisms. Understand the theory of the activated sludge process (ASP) and other treatment systems such as extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactors, and rotating biological contactors. Learn about the evaluation methods used to assess the performance and effectiveness of these treatment strategies. Understand the concept of mass balancing in ASP and TF and its significance in system design. C1 (Remember), C2 (Understanding) Apply knowledge of physio-chemical and biological treatment strategies to select appropriate treatment systems for specific wastewater characteristics and treatment objectives. Apply the principles of the activated sludge process and other treatment systems to design and optimize their performance. Apply evaluation methods to assess the efficiency and effectiveness of different treatment strategies. Apply mass balancing	

	techniques in the design and operation of ASP and TF systems. C3 (Application)
3	Acquire knowledge about anaerobic treatment processes and their significance in wastewater treatment. Understand the effects of pH, temperature, and other parameters on anaerobic treatment performance. Familiarize yourself with different anaerobic treatment technologies, including the anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors, and up flow anaerobic sludge blanket (UASB) reactor. C1 (Remember), C2 (Understanding) Apply knowledge of anaerobic treatment processes to select appropriate treatment technologies for specific wastewater conditions and treatment goals. Apply the understanding of pH, temperature, and other parameters to optimize anaerobic treatment performance. Apply the design principles and operational considerations of anaerobic contact processes, anaerobic filters, anaerobic fixed film reactors, fluidized bed and expanded bed reactors, and UASB reactors. C3 (Application)
4	Acquire knowledge about Indian standards for the disposal of treated wastewater on land and in natural streams. Understand the concept of treated wastewater reclamation and reuse. Familiarize yourself with innovative wastewater treatment technologies such as duckweed ponds, vermiculture, and root zone technology. Stay updated on recent advancements in wastewater treatment technologies. C1 (Remember), C2 (Understanding) Apply knowledge of Indian standards to ensure compliance with regulations for the disposal of treated wastewater. Apply the principles of treated wastewater reclamation and reuse to develop sustainable water management strategies. Apply the understanding of duckweed ponds, vermiculture, and root zone technology to design and implement appropriate wastewater treatment systems. Apply knowledge of recent technologies to select the most suitable treatment methods for specific wastewater streams. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Total Number of Contact Hours	45

Assessment Methods:

Formative	Summative
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:

Text Books

1. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc Graw Hill.

Reference Books

1.Fair, G.M. & Geyer, J.C. "Water supply and Wastewater Disposal", John Wiley & Sons.

2.Qasim, S.R., Motley, E.M., and Zhu, G. "Water Works Engineering", Prentice Hall Publication.

SPECIALIZATION

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107122
Course Title	**Data Visualization**
Academic Year	IV
Semester	VII
Number of Credits	3
Course Prerequisite	A Course on "Data Analysis using Python"
Course Synopsis	The objective of this course is to teach students the concepts of Data Visualization

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

CO1	Build data models and manage and manipulate data to extract useful information and insights
CO2	Apply functions to manipulate and analyze data
CO3	Discover customer preference, purchasing habits, and other behaviors
CO4	Make use of Tableau software for data visualization

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P01 2	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

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

Unit	Content	Competencies
1	Illustrate Data Handling. (C3, Application), Explain Data analysis. (C2, Comprehension), Define Data visualization. (C1, Knowledge), Facilitate statistical formulas (C6, Evaluation), Infer Logical and financial functions. (C4, Analysis)	
2	Explain Power BI Analytics. (C2, Comprehension), Explain Data Validation & data models. (C2, Comprehension), Demonstrate Power Map for visualize data (C3, Application), Evaluate Power BI-Business. (C6, Evaluation), Solve Data Analysis using statistical methods (C3, Application), Explain Dashboard designing. (C2, Comprehension)	

3	Relate Data Manipulation using Function. (C4: Analysis), Construct Heat Map, Tree Map, Smart Chart. (C3, Application), Analyze Azure Machine learning. (C4: Analysis), Construct Column Chart, Line Chart. (C3: Application), Illustrate Pie, Bar, Area, Scatter Chart (C3, Application), Demonstrate Data Series, Axes, Chart Sheet, Trendline (C3, Application)
4	1. Assess Gantt Chart, Pareto Chart. (C6, Evaluation), Diagram Frequency Distribution (C4, Analysis), Practice Pivot Chart, Slicers (C3, Application), Demonstrate Create References, Table Styles (C3: Application), Judge What-If Analysis (C6, Evaluation), Design Correlation model (C5, Synthesis), Explain Regression model (C1. Knowledge)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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**
Assignment / Presentation	☐	☐	☐	☐	☐	☐
Unit test	☐	☐	☐	☐	☐	☐
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. Information Dashboard Design: Displaying Data for At-a-glance Monitoring” by Stephen Few 2. "Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsk

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130107123
Course Title	**Data Visualization Lab**
Academic Year	III
Semester	V
Number of Credits	1
Course Prerequisite	A Course on "Data Analysis"
Course Synopsis	The objective of this course is to teach students theconcepts of Data Visualization and Story Telling

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

CO1	Build data models and manage and manipulate data to extract useful information and insights
CO2	Apply functions to manipulate and analyze data
CO3	Discover customer preference, purchasing habits, and other behaviors
CO4	Make use of Tableau software for data visualization

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

Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**P01 2**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

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

Experiment No.	**Content**
1.	Write a program to Data visualization (C1, Knowledge)
2.	Write a program to analyze data using statistical formulas (C1, Knowledge)
3.	Write a program to Implement Power BI Analytics (C1, Knowledge)
4.	Write a program to design deshboard (C1: Knowledge)
5.	Write a program to implement Heat Map, Tree Map, Smart Chart (C1, Knowledge)
6.	Write a program to implement Column Chart, Line Chart , Pie (C1, Knowledge)
7.	Write a program to implement Bar, Area, Scatter Chart (C1,

	Knowledge)
8.	Write a program for implementing Data Series, Axes. (C1, Knowledge)
9.	Write a program to implement Pivot Chart (C1, Knowledge)
10.	Write a program for Frequency Distribution (C1, Knowledge)

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**
VIVA	☐	☐	☐	☐	☐	☐
Practical Log Book/ Record Book	☐	☐	☐	☐	☐	☐
Demonstration	☐	☐	☐	☐	☐	☐
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 - VIII

Course Code	Course Title
130108111	Earthquake Engineering
130108112	Entrepreneurship & Digital Product Management
130108113	Simulation Lab
130108114	Research Project/ Dissertation
Program Elective-V Pool (Choose One from the pool)	
130108115	Structural Dynamics
130108116	Stochastic Hydrology
130108117	New Age Transit System
130108118	Urban environmental quality Management
Additional Subjects for Specialization Artificial Intelligence and Data Science	
	Neural Network and Deep Learning
	Neural Network and Deep Learning Lab

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130108111
Course Title	**Earthquake Engineering**
Academic Year	IV
Semester	VIII
Number of Credits	3
Course Prerequisite	Soil Mechanics and Structural Engineering
Course Synopsis	Introduction to Dynamic Loads, Basics of Seismology, Behavior of Structures During Earthquake and Earthquake Resistant Features of Structure, Fundamentals of Earthquake Vibrations of Structures, Earthquake Load Analysis on Structures

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

CO1	To provide a coherent development to the students for the courses in sector of earthquake engineering
CO2	To present the foundations of many basic engineering concepts related earthquake engineering
CO3	To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
CO4	To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy

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

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

Course Content:

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

Unit	**Content**	**Competencies**

1	Acquire knowledge about dynamic loads and understand the difference between static and dynamic loads. Identify different types of dynamic forces that act on structures. Learn about force control and displacement control in relation to dynamic loads. C1 (Remember), C2 (Understanding) Acquire knowledge about dynamic loads and understand the difference between static and dynamic loads. Identify different types of dynamic forces that act on structures. Learn about force control and displacement control in relation to dynamic loads. C3 (Application) Analyze the characteristics and effects of dynamic loads on structures. Evaluate the impact of dynamic loads on the stability, strength, and durability of structures. Analyze the behavior of structures under different types of dynamic forces. Differentiate between force control and displacement control approaches and their suitability in various structural applications. C4 (Analysis)
2	Acquire knowledge about the basics of seismology, including the Earth and its interior structure. Understand the concept of plate tectonics and the role of convection currents. Learn about earthquakes, including inter plate and intraplate earthquakes. Familiarize yourself with seismic waves, basic terminology, measuring units, and instruments used in seismology. C1 (Remember), C2 (Understanding) Apply the knowledge of seismology to analyze and interpret seismic data. Apply the principles of plate tectonics to understand the distribution of earthquakes around the world. Use measuring units and instruments to gather data and assess seismic activity in different regions. C3 (Application) Analyze the causes and effects of earthquakes in relation to plate boundaries. Analyze the characteristics of seismic waves and their propagation through the Earth's layers. Examine different types of faults and their role in generating earthquakes. Analyze seismic data to identify patterns and trends in earthquake occurrence. C4 (Analysis)
3	Acquire knowledge about the behavior of reinforced concrete (RC) structures during earthquakes. Understand the load transfer path in RC structures and the concept of strength hierarchy. Learn about the reversal of stresses and the importance of beam-column joints in seismic performance. Familiarize yourself with the significance of stiffness and ductility in structures, following the capacity design concept. Study the effects of various factors on RC structures, such as short columns, soft storeys, improper detailing, masonry infill walls, eccentricity, pounding, floating columns, flexibility, and setbacks. Identify earthquake-resistant features of RC structures. C1 (Remember), C2 (Understanding) Apply the knowledge of RC structures during earthquakes to analyze and evaluate the behavior of specific structural elements and systems. Apply the load transfer path concept to determine the distribution of forces within RC structures. Assess the strength hierarchy and the significance of beam-column joints in the seismic design of RC structures. Apply capacity

	design principles to ensure adequate stiffness and ductility in structural elements. Evaluate the effects of different factors on the seismic performance of RC structures, such as short columns, soft storeys, infill walls, eccentricity, and setbacks. C3 (Application)
4	Acquire knowledge about the equation of motion in mechanical systems. Understand the derivation of the equation of motion using Newton's Law and D'Alembert's Principle. Learn about degrees of freedom in mechanical systems. Familiarize yourself with the simplified single degree of freedom model. Study mathematical modeling techniques for mechanical systems. Understand the equations of motion for free vibration in damped and undamped single degree of freedom systems. Gain knowledge about the equations of motion for forced vibration in damped and undamped single degree of freedom systems. Learn about the logarithmic decrement and its significance in analyzing the damping characteristics of mechanical systems. C1 (Remember), C2 (Understanding) Apply the knowledge of equations of motion to analyze and solve problems related to mechanical systems. Apply Newton's Law and D'Alembert's Principle to derive the equation of motion for specific mechanical systems. Apply the concept of degrees of freedom to determine the number of independent coordinates required to describe the motion of a system. Apply the simplified single degree of freedom model to analyze the response of mechanical systems. Apply mathematical modeling techniques to represent the behavior of mechanical systems mathematically. Solve the equations of motion for free vibration in damped and undamped single degree of freedom systems to determine natural frequencies and mode shapes. Solve the equations of motion for forced vibration in damped and undamped single degree of freedom systems to analyze the response to external excitation. Apply the concept of logarithmic decrement to estimate the damping ratio of mechanical systems. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	Summative
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)

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:

Textbooks

1. S. K. Duggal; Earthquake Resistance Design of Structures; Oxford University Press, New Delhi

Reference Books

1. Earthquake Resistant Design of Structures By Pankaj Agarwal & Manish Shrikhande, PHI Publications
2. Manish Shrikhande & Pankaj Agrawal; Earthquake Resistant Design of Structures, PHI Publication, New Delhi
3. Clough & Penzin; Dynamics of Structures

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130108112
Course Title	**Entrepreneurship & Digital Product Management**
Academic Year	IV
Semester	VIII
Number of Credits	2
Course Prerequisite	NIL
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	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**3**									3	1	2
CO2	**3**	**3**	**3**	**3**	**3**				**3**	**2**	**3**		3	1	3
CO3	**3**	**3**	**3**	**3**	**3**	**2**							3	1	3
CO4	**3**	**3**	**3**	**3**		**3**		**2**			**3**		3	2	2
Average	**3**	**3**	**3**	**3**	**1.2**	**1.6**		**0.8**	**0.6**	**0.4**	**1.4**		3	1.25	2.5

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 digital product management and its key principles C2 (Understanding)	
2.	Opportunity Identification and Market Research. C3 (Application)	
3.	Identifying market gaps and opportunities C4 (Analysis)	
4.	Conducting market research and competitive analysis C4 (Analysis)	
5.	Product Design and User Experience (UX) Design C6 (Create)	
6.	Conducting usability testing and gathering user feedback C5 (Evaluate)	
7.	Managing development cycles and iterative product improvement C6 (Create)	
8.	Testing and quality assurance (QA) processes C5 (Evaluate)	
9.	Product launch strategies and go-to-market planning C6 (Create)	
10.	Developing an entrepreneurial mindset and cultivating creativity C6 (Create)	
11.	Effective communication and storytelling techniques C3 (Application)	
12.	Ethical Considerations in Entrepreneurship and Product Management C3 (Application)	
13.	Privacy, data protection, and responsible product design C6 (Create)	
14.	Social impact and sustainability considerations C5 (Evaluate)	

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**		
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
Course Code	130108113
Course Title	**Simulation Lab**
Academic Year	IV
Semester	VII
Number of Credits	2
Course Prerequisite	NIL
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	PSO1	PSO2	PSO3
CO1	3	3	3	3									3	2	2
CO2	3	3	3	3	3				3	2	3		3	2	2
CO3	3	3	3	3	3	2							3	2	2
CO4	3	3	3	3		3		2			3		3	2	2
Average	3	3	3	3	1.2	1.6		0.8	0.6	0.4	1.4		3	2	2

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 C4 (Analysis)	
2.	Case Study C4 (Analysis)	
3.	Analysis of multi-story building (RCC) C4 (Analysis)	
4.	Case Study C4 (Analysis)	
5.	Analysis of multi-story building (Steel) C4 (Analysis)	
6.	Case Study C4 (Analysis)	
7.	Analysis and design of steel truss C4 (Analysis)	
8.	Case Study C4 (Analysis)	

9.	Analysis of bridge deck C4 (Analysis)
10.	Case Study C4 (Analysis)
11.	Analysis and design of shallow footing C4 (Analysis)
12.	Case Study C4 (Analysis)
13.	Analysis and design of deep footing C4 (Analysis)
14.	Case Study C4 (Analysis)
15.	Analysis and Design of flexible pavement C4 (Analysis)
16.	Case Study C4 (Analysis)
17.	Analysis and Design of rigid pavement C4 (Analysis)
18.	Case Study C4 (Analysis)
19.	Design of wastewater treatment system C6 (Create)
20.	Case Study C4 (Analysis)

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**		
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
Course Code	130108114
Course Title	**Research Project/ Dissertation**
Academic Year	IV
Semester	VII
Number of Credits	10
Course Prerequisite	NIL
Course Synopsis	In this course, student will complete the thesis work.

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

CO1	Solve complex structural problems by applying appropriate techniques and tools.
CO2	Exhibit good communication skill to the engineering community and society.
CO3	Demonstrate professional ethics and work culture.

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

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

Course Content:

L (Hours/Week)	T (Hours/Week)	P (Hours/Week)	Total Hour/Week
0	**0**	**20**	**20**

Experiment No.	Content
1.	Identify the problem (C2, Understand), Implement the suitable solution (C3, Apply), Experiments and tests (C4, Analyze), Investigate and develop the solution (C6, Create)

Teaching - Learning Strategies and Contact Hours

Teaching - Learning Strategies	Contact Hours
Lecture	--
Practical	60
Seminar/Journal Club	--
Small group discussion (SGD)	--
Self-directed learning (SDL) / Tutorial	30
Problem Based Learning (PBL)	180
Case/Project Based Learning (CBL)	30
Revision	--

Others If any:	--
Total Number of Contact Hours	300

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	3. 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
Course Code	130108115
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	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	3	2
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	3	2
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	3	2
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	3	2

Course Content:

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

Unit	Content	Competencies
1	Define & understand the fundamental principles and theories of structural dynamics. Comprehend the meaning and significance of various terms and concepts related to structural dynamics. Explain the different types of dynamic loads and their effects on structures.	

	Understand why structural dynamics is essential in engineering. C1 (Remember), C2 (Understanding) Apply the appropriate terminology and concepts of structural dynamics when discussing and designing structures. Apply the knowledge of different types of dynamic loads to evaluate their impact on the behavior and performance of structures. C3 (Application)
2	Understand the characteristics and behavior of single degree of freedom systems during free vibration. Comprehend how single degree of freedom systems respond to harmonic excitation and transient excitation. Understand the fundamentals of multi-degree of freedom systems. Understand the concept of modal analysis and its application in analyzing the behavior of multi-degree of freedom systems. Understand the equations of motion and eigenvalue problems associated with multi-degree of freedom systems. C1 (Remember), C2 (Understanding) Analyze the free vibration response of single degree of freedom systems using appropriate methods and techniques. Analyze the response of single degree of freedom systems subjected to harmonic excitation and transient excitation. Analyze the dynamic behavior of multi-degree of freedom systems using modal analysis. Analyze the equations of motion and eigenvalue problems to determine the natural frequencies and mode shapes of multi-degree of freedom systems. C4 (Analyze)
3	Understand how free vibration analysis is performed using matrix methods. Comprehend the process of forced vibration analysis using matrix methods. Understand the concept of mode superposition and its application in vibration analysis. C1 (Remember), C2 (Understanding) Analyze the vibration characteristics of continuous systems, such as strings, bars, beams, and plates. Analyze the behavior of these systems under different boundary conditions and loading scenarios. Analyze the natural frequencies, mode shapes, and response of continuous systems to vibrations. C4 (Analyze)
4	Understand the principles of dynamic analysis for structures. Comprehend the role of damping in modifying the structural response to dynamic loads. Understand how response spectrum analysis is used to assess the dynamic behavior of structures. Understand the behavior of reinforced concrete structures under dynamic loading conditions. Understand the design considerations that need to be taken into account for dynamic loads. C1 (Remember), C2 (Understanding) Analyze the dynamic response of structures considering various factors such as material properties, structural geometry, and loading conditions. Analyze the influence of damping on the structural response and its effect on the overall behavior of the structure. Analyze response spectra to determine the peak responses of structures to specific ground motions. Analyze the behavior of reinforced concrete structures under dynamic loads and identify potential failure modes. C4 (Analyze)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	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

SGT UNIVERSITY
Shree Guru Gobind Singh Tricentenary University

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130108115
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	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	2	1
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	1	1
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	2	1
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	1	1
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	1.5	1

Course Content:

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

Unit	Content	Competencies
1	Understand the significance of stochastic hydrology in engineering and water resources management. Comprehend the principles and applications of probability theory and statistical distributions in stochastic hydrology. Understand the purpose and techniques of	

	descriptive statistics and exploratory data analysis in analyzing hydrological data. C1 (Remember), C2 (Understanding) Apply the principles of stochastic hydrology to analyze and predict hydrological events and processes. Apply probability theory to assess the likelihood of various hydrological events. Apply statistical distributions to model and analyze hydrological variables. Apply descriptive statistics and exploratory data analysis techniques to summarize and visualize hydrological data. C3 (Application)
2	Understand the process of hydrological data analysis, including data collection methods and the need for data preprocessing. Comprehend the significance of visualizing hydrological data to identify trends, patterns, and outliers. Understand the purpose and interpretation of summary statistics in describing the central tendency, dispersion, and shape of hydrological variables. Understand the principles of hypothesis testing and how it is used to make inferences about hydrological phenomena. C1 (Remember), C2 (Understanding) Analyze hydrological data through appropriate data preprocessing techniques, such as data cleaning, filtering, and transformation. Analyze and interpret data visualizations to identify patterns, trends, and anomalies in hydrological data. Analyze summary statistics to gain insights into the central tendency, variability, and distributional characteristics of hydrological variables. Analyze the results of hypothesis tests to draw conclusions about the relationships or differences in hydrological data. C4 (Analyze)
3	Understand the nature and characteristics of stochastic processes in hydrology. Comprehend the principles and applications of Markov chains in modeling hydrological phenomena. Understand the significance of time series analysis in analyzing and modeling hydrological data. C1 (Remember), C2 (Understanding) Analyze the behavior and properties of stochastic processes in hydrology, including stationarity, ergodicity, and dependence structure. Analyze the transition probabilities and equilibrium states of Markov chains to understand the dynamics of hydrological systems. Analyze time series data to assess the presence of autocorrelation, seasonality, and other temporal patterns in hydrological variables. C4 (Analyze)
4	Understand the principles and methods of frequency analysis in hydrology. Comprehend the relationship between return period and exceedance probability in quantifying the likelihood of hydrological events. Understand the concept of probability distributions and their role in representing hydrological variables. Understand the purpose and techniques of flood frequency analysis. C1 (Remember), C2 (Understanding) Analyze the statistical properties of hydrological data to select appropriate probability distributions for frequency analysis. Analyze the parameters of probability distributions using statistical techniques, such

	as maximum likelihood estimation. Analyze the results of frequency analysis to derive flood frequency curves and estimate flood magnitudes for different return periods. C4 (Analyze)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	Text Books 1. Water Resources Systems Planning and Management: An Introduction to Methods, Models, and Applications" by Daniel P. Loucks and Eelco van Beek **Reference Books** 1. Stochastic Modeling of Scientific Data" by Peter Guttorp 2. Time Series Analysis: Forecasting and Control" by George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, and Greta M. Ljung 3. Stochastic Hydrology and Its Use in Water Resources Systems Simulation and Optimization" by Keith W. Hipel and Felix A. Létourneau

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130108117
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	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	3	3	2
CO2	2	3	2	3	3	2	2	3	3	3	3	3	3	1	2
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	3	2
CO4	3	3	3	2	3	2	3	3	2	1	2	1	3	3	2
Average	2	3	2	2	2	2	2	3	3	2	3	2	3	2.5	2

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

Unit	**Content**	**Competencies**
1	Understand the conSScept of new age transit systems and their distinguishing features in comparison to traditional transportation	

	modes. Comprehend the impact of emerging trends, such as digitalization, automation, and electrification, on the transportation sector. Understand the role of socioeconomic and environmental factors in shaping the need for innovative transportation solutions. C1 (Remember), C2 (Understanding) Apply the knowledge of new age transit systems to analyze real-world transportation scenarios. Apply the understanding of emerging trends and technologies to assess the feasibility and potential benefits of implementing new age transportation solutions. Apply the understanding of socioeconomic and environmental factors to evaluate the relevance and sustainability of new age transit systems in specific contexts. C3 (Application)
2	Understand the role and significance of each component and technology in ITS. Comprehend the various applications and benefits of traffic management systems in improving transportation efficiency and safety. Understand how intelligent infrastructure and vehicle-to-infrastructure communication contribute to the overall effectiveness of ITS. C1 (Remember), C2 (Understanding) Apply knowledge of ITS components and technologies to analyze and propose solutions for transportation challenges. Apply understanding of traffic management systems to develop strategies for optimizing traffic flow and reducing congestion. Apply knowledge of intelligent infrastructure and vehicle-to-infrastructure communication to design systems that enable effective information exchange and coordination in transportation networks. C3 (Application)
3	Understand the basic features and components of electric vehicle (EV) technology and infrastructure. Remember the fundamental concepts and models of shared mobility and Transportation as a Service (TaaS). Recall the implications and challenges associated with the adoption of electric and autonomous vehicles (EVs and AVs). C1 (Remember), C2 (Understanding) Evaluate the effectiveness of EV technology and infrastructure in reducing carbon emissions and promoting sustainable transportation. Evaluate the potential benefits and drawbacks of different models of shared mobility and TaaS in terms of efficiency and environmental impact. Assess the challenges and risks associated with the adoption of EVs and AVs from various perspectives, such as safety, infrastructure, and public acceptance. C5 (Evaluate)
4	Understand the different types of alternative fuels and energy sources available for transportation, such as biofuels, hydrogen, and electric power. Comprehend the principles and strategies involved in sustainable urban transportation planning and design, including transit-oriented development and non-motorized transportation. Understand the concept of multi-modal transportation systems and the importance of integrating

	different modes of transportation. C1 (Remember), C2 (Understanding) Analyze the environmental, economic, and social impacts of different alternative fuels and energy sources in transportation. Analyze urban transportation systems and infrastructure to identify opportunities for improvement in terms of sustainability and efficiency. Analyze the integration of different modes of transportation to assess the benefits and challenges of multi-modal systems. C4 (Analyze)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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:	
	Text Books 1. Intelligent Transportation Systems: Functional Design for Effective Traffic Management" by Asad Khattak and Luis F. Miranda-Moreno **Reference Books** 1. Autonomous Vehicles: Intelligent Transport Systems and Smart Technologies" by Felipe Jimenez and Ángel Iglesias 2. Shared Mobility and the Transformation of Public Transit" by Transit Cooperative Research Program (TCRP) 3. Sustainable Transportation Planning: Tools for Creating Vibrant, Healthy, and Resilient Communities" by Jeffrey Tumlin 4. Electric Vehicle Technology Explained" by James Larminie and John Lowry

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	130108118
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P0 12	PS O1	PS O2	PS O3
CO1	1	2	1	2	2	2	1	2	2	1	2	2	**3**	**2**	
CO2	2	3	2	3	3	2	2	3	3	3	3	3	**3**	**2**	**2**
CO3	1	2	1	2	1	2	1	2	3	3	3	3	**3**	**2**	**2**
CO4	3	3	3	2	3	2	3	3	2	1	2	1	**3**	**2**	**2**
Average	2	3	2	2	2	2	2	3	3	2	3	2	**3**	**2**	**2**

Course Content:

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

Unit	Content	Competencies

1	Understand the concept of urban environment quality management and its importance in creating livable and sustainable cities. Comprehend the key challenges and issues that arise in managing the quality of urban environments, such as pollution, resource depletion, and urban sprawl. Understand the principles and goals of sustainable development and how they can be applied to improve urban environments. C1 (Remember), C2 (Understanding) Apply knowledge of urban environment quality management to analyze and propose solutions for addressing specific challenges in urban settings. Apply the principles of sustainable development to develop strategies and plans for enhancing the quality of urban environments. Apply appropriate tools and techniques to monitor and assess the environmental performance of urban areas. C3 (Application)
2	Understand the various sources of air pollution in urban areas, including industrial emissions, vehicular pollution, and residential activities. Comprehend the adverse effects of air pollution on human health, such as respiratory diseases and cardiovascular problems, as well as its impact on ecosystems and climate. Understand the different techniques and instruments used for monitoring and assessing urban air quality. Understand the principles behind strategies for controlling and mitigating air pollution in cities. C1 (Remember), C2 (Understanding) Apply knowledge of urban air pollution sources and impacts to identify and assess specific air quality issues in urban areas. Apply monitoring and assessment techniques to measure and evaluate air pollution levels in different locations. Apply strategies and measures for air pollution control and mitigation in urban settings, considering factors such as emission controls, vehicle regulations, and urban planning. C3 (Application)
3	Understand the various sources of water pollution in urban areas, such as industrial discharges, stormwater runoff, and wastewater effluents. Comprehend the challenges and complexities involved in managing water quality in urban environments. Understand the different methods and techniques used for monitoring and assessing urban water quality. Understand the significance of prevention and management strategies for urban water pollution. C1 (Remember), C2 (Understanding) Apply knowledge of water pollution sources and challenges to identify and assess specific water quality issues in urban areas. Apply water quality monitoring and assessment methods to evaluate the condition of urban water bodies. Apply approaches and measures for preventing and managing water pollution in urban settings, including pollution control regulations, green infrastructure, and wastewater treatment technologies. C3 (Application)
4	Understand the different sources of urban noise and vibrations, including transportation, construction, and industrial activities. Comprehend the effects of noise and vibrations on human health, well-being, and the environment. Understand the methods and technologies used for

	monitoring and assessing noise levels in urban areas. Understand the principles and approaches of noise control and mitigation in urban environments. Understand the concept of innovative solutions for managing urban environmental quality. C1 (Remember), C2 (Understanding) Apply knowledge of urban noise and vibrations to identify and assess specific noise-related issues in urban areas. Apply noise monitoring and assessment techniques to evaluate the noise levels in different urban settings. Apply noise control and mitigation measures in urban environments, such as soundproofing, zoning regulations, and traffic management strategies. Apply innovative approaches and technologies for managing and improving urban environment quality. C3 (Application)

Teaching - Learning Strategies and Contact Hours

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

Assessment Methods:

Formative	**Summative**
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	✓	✓	✓	✓		

<table>
<tr><td colspan="2">University Examination</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="2">Feedback Process</td><td colspan="6">1. Student’s Feedback</td></tr>
<tr><td colspan="8">Students Feedback is taken through various steps
1. Regular feedback through Mentor Mentee system
2. Feedback between the semester through google forms</td></tr>
<tr><td>References:</td><td colspan="7"></td></tr>
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Reference Books
1Urban 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</td></tr>
</table>

SPECIALIZATION

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Neural Network and Deep Learning**
Academic Year	IV
Semester	VIII
Number of Credits	3
Course Prerequisite	A Course on "Data Analysis using Python", Machine Learning and Pattern Recognition
Course Synopsis	The objective of this course is to teach students the concepts of Neural Network and Deep Learning

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

CO1	Understand Neural Networks
CO2	Train Feed-Forward Neural Networks
CO3	Understand TensorFlow
CO4	Understand the Neural Networks and its usage in machine learning application.

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

	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	2. Student's Feedback					

Students Feedback is taken through various steps

3. Regular feedback through Mentor Mentee system
4. Feedback between the semester through google forms

References:	
	Text Books 1. Urban Environmental Management and Technology" by Kevin Nelson **Reference Books**

	1Urban 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

Faculty of Engineering & Technology	
Name of the Department	Civil Engineering
Name of the Program	Bachelor of Technology
Course Code	
Course Title	**Introduction to AI and ML Lab**
Academic Year	IV
Semester	VIII
Number of Credits	1
Course Prerequisite	A Course on "Data Analysis using Python", Machine Learning and Pattern Recognition
Course Synopsis	The objective of this course is to teach students the concepts of Neural Network and Deep Learning

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

CO1	Understand Neural Networks
CO2	Train Feed-Forward Neural Networks
CO3	Understand TensorFlow
CO4	Understand the Neural Networks and its usage in machine learning application.

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

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P01 2	PS O1	PS O2	PS O3
CO1	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO2	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	1	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	1	-	-	-	-	-
Average	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

Course Content:

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

Experiment No.	Content
1.	Write a program to install TensorFlow (C1, Knowledge)Write a program to install TensorFlow (C1: Knowledge)
2.	Write a program to write Hello World Program in TensorFlow1.0 and compare with Python (C1, Knowledge)
3.	Write a program to construct and manage graph (C1, Knowledge)
4.	Write a program to implement fetches in TensorFlow(C1, Knowledge)
5.	Write a program to implement constants, variables, placeholders(C1, Knowledge)
6.	Write a program to implement tfprint() command in TensorFlow2.x(C1, Knowledge)
7.	Write a program to compare Lazy Execution vs Eager Execution (C1,

	Knowledge)
8.	Write a program to implement tf.global_variables_initializer() in TensorFlow 1.x and alternate in TensorFlow2.x. (C1, Knowledge)
9.	Write a program to implement Feature Columns in TensorFlow2.x(C1, Knowledge)
10.	Write a program to build data pipelines in TensorFlow(C1, Knowledge)

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
VIVA	✓	✓	✓	✓	✓	✓
Practical Log Book/ Record Book	✓	✓	✓	✓	✓	✓
Demonstration	✓	✓	✓	✓	✓	✓
University Examination(External Practical)	✓	✓	✓	✓	✓	✓
Feedback Process	2. Student's Feedback					

Students Feedback is taken through various steps

3. Regular feedback through Mentor Mentee system
4. Feedback between the semester through google forms

9. MAPPING OF COURSE OUTCOMES, PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Sem.	Course Code	Course Title	C	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	130101111	Engineering Mathematics-I	4	3	1.75	-	-	-	-	-	-	-	-	-	4	4	-	4
I	130101112	Programming for Problem Solving	2	1	1.25	1	1	2	-	-	-	3		1	1	1	2	1
I	130101113	Programming for Problem Solving Lab	1	3.0	1.8	2.3	0.8	1.0	0.5	-	-	-	-	1.3	2.5	3.0	2.0	0.5
I	130101114	Engineering Workshop	2	3.0	1.8	2.3	3	2	1	-	-	-	-	1.3	2.5	3.0	2.0	1
I	130101115	Engineering Workshop Lab	2	3.0	1.8	2.3	0.8	1.0	0.5	-	-	-	-	1.3	2.5	3.0	2.0	0.5
I	130101	Design	2	3	2.	0.	1.	2.	-	-	-	-	2	2.	3.	2.0	1.5	3

	116	Thinking			5	8	5	5						5	0			
II	130102111	Engineering Mathematics-II	2	3.0	1.8	2.3	0.8	1.0	0.5	-	-	-	-	1.3	2.5	3.0	2.0	0.5
II	130102112	Basics of Electrical & Electronics Engineering	2	2.5	1	1	-	-	1	-	-	-	2	-	-	3.0	1	-
II	130102113	Basics of Electrical & Electronics Engineering Lab	1	2	0.75	1	0.75	3	-	-	-	-	2	-	-	3.0	2.0	1
II	130102114	Engineering Graphics and Design	2	2	0.75	1	0.75	3	-	-	-	-	2	-	-	3.0	2.0	1
II	130102	Enginee	2	2	1	1	1	3	-	-	-	-	2	-	-	3.0	2.0	1

	115	ring Graphics and Design Lab																
II	130102116	New Age Skills	3	2	1	1	0.75	3	-	-	-	-	2	1	1	3.0	2.0	1
II	130103111	Strength of Materials	3	3	3	3	3	1.5	1	1	2	2	2	2	1	3	1	1
III	130103112	Strength of Materials Lab	1	3	3	3	3	2	-	1	1	-	-	1	1	3	1	1
III	130103113	Surveying	2	3	3	3	3	2	-	-	-	-	-	1.2	1	3	-	2.75
III	130103114	Surveying Lab	2	3	3	3	3	2	-	-	-	-	-	1.2	1	3	-	2.6
III		Civil Engineering Drawing Lab																
III	130103117	Civil Infrastru	3	2	3	2	2	2	2	2	3	3	2	3	2	2	3	1.5

		cture and Society																
III	130103115	Building Construction & Material	2.5	3	0.5	3	1.3	1.5	0.3	1.1	0.5	0.3	1.1		3	1.33	1.73	2.5
III	130103119	Introduction to Sustainable development	3	3	3	3	3	2	2.5	2.25	2	2	1.5	1	1	3	2.75	2
III	130103120	Air, Noise Pollution and Control	3	3	3	3	3	2	2.5	1	1.5	1	1.5	1.5	1	3	1.67	1
III	130103121	Introduction To Data Science	3	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
III	130103122	Introduction To Data Science Lab	1	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

III	130104111	Structural Analysis	3	3	3	2	2	1	1	-	3	2	1	3	-	3	1	2
IV	130104112	Fluid Mechanics	3	3	3	3	3	3	1	-	-	2	-	2	-	3	1	1
IV	130104113	Fluid Mechanics Lab	1	3	3		3	3	2			2		2	3	3	1	1
IV	130104114	Concrete technology	3	2.3	3	2.8	3	3	2.6	1.6	2.6	2	2	2.8	2.1	3	2	2
IV	130104115	Concrete Technology Lab	1	2.3	3	2.8	3	3	2.6	1.6	2.6	2	2	2.8	2.1	3	2	2
IV		GIS Lab	2	2.8	2.2	2.2	2.2	3	2.6	2.6	1.4	2	1.4	2	2.6	3	3	2
IV	130104117	Advanced Surveying	3	3	3	3	3	2	2	1	1	1	1	1	1	3	1	1.75
IV	130104118	Environment impact assessm	3	3	3	3	3	2	2	2	2	1	1	1	1	3	2	2

		ent																
IV	130104119	Engineered Systems and Sustainability	3	3	3	3	3	2	2	1	1	2	1.4	1	1	2	3	1
IV	130104120	Introduction to AI and Data Analytics for Civil Engineering	3	3	3	3	3	2	1	1	1.25	1.25	1.25	1.25	1	2	-	1
IV	130104121	Data analysis using Python	3	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
IV	130104122	Data analysis using Python Lab	1	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
V	130105111	Reinforced Concret	4	3	2.7	2.7	2.7	1.5	-	-	3	2.5	2.5	2.67	2.5	3	2.25	1

		e Structures-I																
V	130105112	Hydrology	3	3.0	2.3	2.0	3.0	1.3	2.7	3.0	3.0	3.0	1.7	2.0	2.7	3	1.33	1
V	130105113	Soil Mechanics	3	2.8	2.8	2.5	1.5	1.5	2	1.8	2	2.3	2.8	3	3	3	2	1.5
V	130105114	Soil Mechanics Lab	1	3	2.3	1.8	2	1.5	1.3	2	1.8	1.8	1.3	1.6	1.8	3	2	1.67
V	130105115	Engineering Geology	2	3	3	3	2.8	2.8	2	2.5	2.8	2.5	2.8	2.3	2.8	3	1	1.25
V	130105116	SEC-III (BIM Lab)	2	3	2.3	1.8	1	1	1.3	1	1.8	1.8	1.3	1.5	1.8	3	2	1.67
V	130105118	Advanced Structural Analysis	3	3	3	3	3	2	2	1.67	1	1.67	1.567	1	1	3	1	1
V	130105119	Open channel flow	3	3	3	3	3	2	2	2	1	2	2	1	1	3	1.33	1
V	130105	Disaster Control	3	3	3	3	2.	2.	0.	1.	2.	2.	2.	2.	2.	3	3	2.2

	120	and Management					8	8	5	33	8	5	8	3	8			
V	130105121	Earth and Environment	3	3	3	3	2.8	2.8	0.5	1.33	2.8	2.5	2.8	2.3	2.8	3	1.4	1
V	130105122	Introduction to AI and ML	3	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
V	130105123	Introduction to AI and ML Lab	1	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
VI	130106111	Design of Steel Structures-I	4	1.3	2.3	1.8	2.0	1.3	2.3	1.8	3.0	1.8	2.0	1.8	2.0	3	3	2
VI	130106112	Water Treatment & Supply Systems	3	2.5	2.8	3	2.5	-	3	2.8	3	2.5	2.8	2.2	2.5	3	2.5	1
VI	130106113	Water Treatment &	1	2.5	2.8	3	2.5	-	3	2.8	3	2.5	2.8	2.2	2.5	3	2.5	1

		Supply Systems Lab															
VI	130106114	Highway Engineering	3	3	3	3	2.8	2.8	0.5	1.2	2.8	2.5	2.8	2.2	2.8	3	2.75	2
VI	130106115	Highway Engineering Lab	1	3	3	3	3	3	2	3	3	2.3	2.6	2.3	2.6	3	3	2
VI	130106116	Geo-Technology	3	3	3	2.5	2.2	2	-	-	2	-	-	2	-	3	2	1.6
VI	130106117	Civil Engineering Design Lab	2	2.25	3	2.25	2.25	2	2.5	1.5	2	1.75	2.25	1.5	1.5	3	2	1.5
VI	130106118	Reinforced Concrete Structures-II	3	3	3	2.5	2.2	2	-	-	2	-	-	2	-	3	2.25	1.25
VI	130106119	Construction	3	3	3	2.5	2.2	2	-	-	2	-	-	2	-	3	2.4	2.6

		Safety																
VI	130106120	Energy Efficient Structure	3	3	3	2.5	2.2	2	-	-	2	-	-	2	-	3	3	1
VI	130106121	Introduction to Smart Cities	3	3	3	2.5	2.2	2	-	-	2	-	-	2	-	3	2	1
VI	130106122	Data Mining	3	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
VI	130106123	Data Mining Lab	1	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
VII	130107111	Irrigation Engineering	3	3	3	3	3	2	2	2	2	2	1	2	1	3	2.5	1.5
VII	130107112	Estimation & Costing	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2.25
VII	130107113	Construction Project Management	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2.5	2

VII	130107114	Construction Project Management Lab	1	3	3	3	3	1.2	1.6		0.8	0.6	0.4	1.4		3	2.5	2
	130107115	Capstone Project	2	3	3	3	3	3	2	2	1	2	2	-	1	3	2	2
VII	130107116	Valuation & Costing Lab	2	3	3	3	3	3	2.5	-	2	3	2	3	-	2	1	1
VII	130107118	Bridge Engineering	3	2	3	2	2	2	2	2	3	3	2	3	2	3	3	2
VII	130107119	Ground water engineering	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2.5	2.75
VII	130107120	Railways, Tunnel and Airport Engineering	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2
VII	130107	Waste	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2.8	1.6

	121	water treatment																
VII	130107122	Data Visualization	3	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
VII	130107123	Data Visualization Lab	1	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
VIII	130108111	Earthquake Engineering	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2	1
VIII	130108112	Entrepreneurship & Digital Product Management	2	3	3	3	3	1.2	1.6	-	0.8	0.6	0.4	1.4	-	3	1.25	2.5
VIII	130108113	Simulation Lab	2	3	3	3	3	1.2	1.6		0.8	0.6	0.4	1.4		3	2	2
VIII	130108114	Research Project/ Disserta	10	3	3	3	3	3	2	2	1	2	2	-	1	3	2	2

		tion																
VIII	130108115	Structural Dynamics	3	2	3	2	2	2	2	2	3	3	2	3	2	3	3	2
VIII	130108116	Stochastic Hydrology	3	2	3	2	2	2	2	2	3	3	2	3	2	3	1.5	1
VIII	130108117	New Age Transit System	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2.5	2
VIII	130108118	Urban environmental quality Management	3	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2
VIII		Neural Network and Deep Learning	3	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-
VIII		Neural Network	1	3	3	-	-	1.25	-	-	-	-	1	-	-	-	-	-

		and Deep Learning Lab																

Note: C-Credits

Annexure

(Program Name)

Course Plan

Course Title:			**Course Code:**	
Total Credits:	**L**	**T**	**P**	**Hour/Week**

Course Content:			
Unit	**Content**	**No. of Hours**	**Mode of Delivery**
1			
2			
3			
4			
5			
6			
	Total Hours		

Note – L: Lecture Hour/week, T: Tutorial Hour/week, P: Practical Hour/week