Bharati Vidyapeeth

(Deemed to be University)

Pune, India

College of Engineering, Pune

Program Curriculum

B.Tech (Civil Engineering)-2023

Sem – V & VI

(As Per NEP 2020 Guidelines)

(w.e.f. from 2025-26)

VISION OF UNIVERSITY:

Social Transformation through Dynamic Education

MISSION OF UNIVERSITY:

- To make available quality education in different areas of knowledge to the students as per their choice and inclination
- To offer education to the students in a conducive ambience created by enriched infrastructure! and academic facilities in its campuses.
- To bring education within the reach of rural, tribal and girl students by providing them substantive fee concessions and subsidized hostel and mess facilities
- To make available quality education to the students of rural, tribal and other deprived sections of the population

VISION OF THE INSTITUTE

To be World Class Institute for Social Transformation through Dynamic Education.

MISSION OF THE INSTITUTE

- To provide quality technical education with advanced equipment, qualified faculty members, infrastructure to meet needs of profession and society.
- To provide an environment conducive to innovation, creativity, research and entrepreneurial leadership.
- To practice and promote professional ethics, transparency and accountability for social community, economic and environmental conditions.

DEPARTMENT OF CIVIL ENGINEERING

VISION OF DEPARTMENT

To create Civil Engineers who will transform Civil Engineering Industry for sustainable development of society.

MISSION OF DEPARTMENT

- To create Civil Engineers enriched with quality technical education.
- To create entrepreneurs practicing professional ethics.
- To inculcate innovation, creativity and research approach among the graduants.

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE

PROGRAMME: B.TECH (CIVIL ENGINEERING)

Programme Educational Objectives (PEOs):

PEO1: To prepare students for career in Civil Engineering Profession.

PEO2: To develop a responsible 'Entrepreneur.'

PEO3: To develop the student to cope up with the advancements in Civil Engineering.

Programme Outcomes (PO): An Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering

management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Programme Specific Outcomes (PSOs): A Civil Engineering Graduates will be able to:

PSO1: Industry Exposure: adapt to work and address challenges in construction Industry.

PSO2: Optimal and Sustainable Solution: workout optimal and sustainable solution to infrastructural needs of the society

Codes & Abbreviations

Programme Code:

Commencement/ Revised Year	Faculty Code (Engg & Tech)	Programme Type (UG)	Programme Number	Programme Code
xx	xx	x	xx	xxxxxxx
23	11	2	02	2311202

Course Code:

Type of Course	Faculty Code	Programme Number	Sem/Year	Course Number	Course Code
xx	xx	xx	x	xx	xxxxxxxxx
BS	11	13	3	01	BS1113301

Abbreviation

BS	Basic Science	MJ	Major (Core) Course
MI	Minor Course	GE	General Elective Course
OE	Open Elective Course	SE	Skill Enhancement Course
AE	Ability Enhancement Course	VE	Vocational Enhancement Course
VS	Vocational Skill Course	VA	Value Added Course
CC	Co-Curricular Course	ID	Interdisciplinary Course
MD	Multi-disciplinary Course	RP	Research/Project Course
PC	Practical Course	EC	Social Activity
AC	Audit Course	BM	Basic Mathematics
BC	Basic Physics	BP	Basic Physics
EG	Engineering Graphics	ES	Engineering Science
UH	Universal Human Values	PE	Program Elective

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

COLLEGE OF ENGINEERING, PUNE

B. Tech. (Civil Engineering): Semester –V (2023 COURSE)- 2311202

(w.e.f AY 2025-26)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	IA	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	MJ	MJ1102501	Structural Analysis-II	3	-	-	60	40	-	-	-	**100**	3	-	-	**3**
2.	MJ	MJ1102502	Design of Steel Structures	3	2	1	60	40	25	-	25	**150**	3	1	1	**5**
3.	MJ	MJ1102503	Water Supply Engineering	3	2	-	60	40	25	25	-	**150**	3	1	-	**4**
4.	MJ	MJ1102504	Transportation Engineering	3	-	-	60	40	-	-	-	**100**	3	-	-	**3**
5.	MJ	MJ1102505	Quantity Estimation and Valuation	3	2	-	60	40	25	-	25	**150**	3	1	-	**4**
6.	SE	SE1102506	Skill based Course – V (Computer Aided Estimation & Costing)	-	2	-	-	-	25	25	-	**50**	-	1	-	**1**
7.	*AC	AC1102507	Environmental Studies	4	-	-	40+ 20*	30+ 10**	-	-	-	**100**	4	-	-	**4**
			Total	**19**	**08**	**1**	**360**	**240**	**100**	**50**	**50**	**800**	**19**	**4**	**1**	**24**

Environmental Studies: as per UGC guidelines

* 1. ESE: a. 40 Marks (MCQ based end of semester/term university examination, for Units I to VIII)
b. 20 Marks (Case Studies and Field Work report and presentation in a group, for Unit IX)

** 2. IA: a. 30 Marks (Internation assessments comprising of Assignments/Seminars/Class work/Tests/projects, etc, for Unit I to VIII)
b. 10 Marks - Attendance for Unit I to VIII

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COLLEGE OF ENGINEERING, PUNE

B. Tech. (Civil Engineering): Semester –VI (2023 COURSE)- 2311202

(w.e.f AY 2025-26)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	IA	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	MJ	MJ1102601	Design of Reinforced Concrete Structures	3	2	-	60	40	25	-	25	**150**	3	1	-	**4**
2.	MJ	MJ1102602	Wastewater Engineering	3	2	-	60	40	25	-	25	**150**	3	1	-	**4**
3.	MJ	MJ1102603	Advanced Transportation Engineering	3	2	-	60	40	25	-	-	**125**	3	1	-	**4**
4.	MJ	MJ1102604	Water Resources Engineering	3	-	-	60	40	-	-	-	**100**	3	-	-	**3**
5.	PE	PE1102605	Program Elective I	3	-	-	60	40	-	-	-	**100**	3	-	-	**3**
6.	SE	SE1102606	Skill Based Course–VI (Computer Aided Structural Analysis and Design)	-	2	-	-	-	25	25	-	**50**	-	1	-	**1**
7.	SE	SE1113607	Professional Skills	-	2	-	-	-	25	-	-	**25**	-	1	-	**1**
			Total	**15**	**10**	**-**	**300**	**200**	**125**	**25**	**50**	**700**	**15**	**5**	**-**	**20**
8	*VA	VA1102608	Value Added Course- II	2	-	-	-	100	-	-	-	100	2	-	-	2
9	*AE	AE1102609	MOOC - II	-	-	-	-	-	-	-	-	-	-	-	-	2

*** mandatory course but the credits will not be considered in SGPA/CGPA**

Courses for Program Elective (PEC)-I

S. No.	Specialization	PEC-I (Semester-VI)
1	Concrete Technology & Composite	Advanced Concrete Technology
2	Construction management	Construction Management
3	Environmental Engineering	Solid Waste Management
4	Geoinformatics	Modern Geodesy and GPS Techniques
5	Geotechnical Engineering	Ground Improvement Techniques
6	Structural Engineering	Structural Assessment & Retrofitting
7	Town and Country Planning	Urban Development
8	Water Resource Engineering	Hydrology

Programme:
B. Tech. (Civil)-2023
Sem – V

Programme: B. Tech. (Civil) Sem – V (2023 Course)

COURSE: STRUCTURAL ANALYSIS - II		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs. / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Engineering Mechanics
2	Mechanics of Solids
3	Structural Analysis – I
Course Objective: On completion of the course -	
	the student should be able to analyse the indeterminate beams and frames.
Course Outcomes: On completion of the course, the students will be able to -	
1	calculate plastic moment capacity of section.
2	analyse indeterminate truss using strain energy method.
3	calculate fixed end moments.
4	analyse plane structure using slope deflection method.
5	analyse plane structure using moment distribution method.
6	analyse frame using approximate method and two hinged arch for static loading.

Course Content:

Unit-I	**Plastic Analysis of Structure:** Elastic and Plastic moment capacity, Plastic hinge, Shape factor, Collapse mechanism, Applications to continuous beam, fixed beam, propped cantilever beam, single bay single storied rectangular frame.	**(06 Hrs.)**
Unit-II	**Analysis of Indeterminate Plane Trusses using Castigliano's theorem:** Analysis of indeterminate trusses by application of Castigliano's second theorem; Effect of Internal and External indeterminacy, Effect of Lack of fit, Temperature changes and Sinking of support (Maximum 2 degree of indeterminacy).	**(06 Hrs.)**
Unit-III	**Fixed Beam and Clapeyron's Three Moment Theorem:** Fixed Beam: Calculation of fixed end moments due to different types of loads; Effect of sinking of support. Clapeyron's Three moment theorem: Analysis indeterminate beams using Three Moment Theorem for different support conditions; Effect of sinking of support.	**(06 Hrs.)**
Unit-IV	**Slope Deflection Method:** Analysis of continuous beams using slope deflection method-sinking and rotation at support; Analysis of non-sway and sway rectangular portal frames (with indeterminacy up to 3 degrees).	**(06 Hrs.)**
Unit-V	**Moment Distribution Method:** Analysis of continuous beams using moment distribution method-sinking and rotation at support; Analysis of non-sway and sway rectangular portal frames	**(06 Hrs.)**

	(with indeterminacy up to 3 degrees).	
Unit-VI	**Approximate Methods of the Analysis:** Approximate methods of analysis of frame by Portal and Cantilever method. Analysis of Two-Hinged arch for static loading.	**(06 Hrs.)**

Reference Books:	
1	Bhavikatti S.S., "Structural Analysis- I and II", Vikas Publication
2	Menon Devdas "Structural Analysis", Alpha Science International Publication
3	Ramamrutham S. & Narayan R., "Theory of Structures", Dhanpat Rai Publishing Company
4	Prakash Rao D. S., "Structural Analysis", Universities Press Publication
5	Hibbeler R. C., "Structural Analysis", Prentice Hall Publication
6	Aslam Kassimali, "Structural Analysis", Cengage Learning
7	Pandit G. S. & Gupta S. P., "Theory of Structures Vol-I", Tata McGraw Hill Publication
8	Timoshenko S. P. & Young, "Theory of Structures", McGraw Hill Publication
Reference Links: List of Open Source learning website:	
1	https://nptel.ac.in/courses/105101086
2	https://nptel.ac.in/courses/105105109

Programme: B. Tech. (Civil) Sem – V (2023 Course)

COURSE: DESIGN OF STEEL STRUCTURES		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week Tutorial : 01 Hr / Week Practical : 02 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks Term work : 25 Marks Oral : 25 Marks	Theory : 03 Tutorial : 01 Practical : 01
	Total : 150 Marks	Total : 05

Course Pre-requisites: The students should have knowledge of	
1	Mechanics of Solids
2	Structural Analysis
Course Objective: On completion of the course -	
	the student should be able to design different structural steel members using Indian Standard code of practice with consideration to safety, serviceability and economy.
Course Outcomes: On completion of the course, the students will be able to -	
1	estimate design load.
2	design connections for axial load.
3	design members for axial tension.
4	design members for axial compression.
5	design built-up columns.
6	design beams.

Course Content:

Unit-I	**Design Philosophy:** Types of structural elements and their behavior, Introduction to IS875, Types of Loads, Estimation of Loads, Wind Load on Roof Truss. Load combinations, Design Load. Steel as structural material, Type of structural steel, Mechanical Properties, Rolled steel sections and engineering properties, Introduction to SP6(1), Strength of Section, Design strength, Partial safety factors, Concept of Limit state design, Introduction to IS800.	**(06 Hrs)**
Unit-II	**Design of Connections for Axial Load:** Types of fasteners, advantages and disadvantages, Types of bolts, Design strength of bolts, Design of bolted connection and detailing, Strength of weld, Design of weld and detailing.	**(06 Hrs)**
Unit-III	**Design of Axially Loaded Tension Members:** Behavior of member in tension, Axial tension capacity of plates, single and double angles and channel section, Design of axially loaded Tension members.	**(06 Hrs)**
Unit-IV	**Design of Axially Loaded Compression Members:** Behavior of member in compression, Concept of Effective Lengths, Axial compression capacity of single and double angle section, Design of axially loaded compression members	**(06 Hrs)**

Unit-V	**Design of Built-up Column and Column Base:** Axial compression capacity of Built-up Column, Design of built-up column, Design of Lacing system, Design of battening system, Design of slab base, Design of gusseted base.	**(06 Hrs)**
Unit-VI	**Design of Beams:** Behavior of beams, Shear and moment capacity of Laterally supported and laterally unsupported beam. Design of beam, Design of built-up section, Curtailment of plates, Design of bolted connections for shear and moment.	**(06 Hrs)**

Term work: A) The term work shall consist of minimum **any ONE** projects with 2 numbers of half imperial sheets based on following topics:

1	Design of roof truss: Load estimation, Analysis of truss, Design force for member, Design of Members, Design of connection, Design of Purlin, Drawing.
2	Design of Building: Load estimation, Analysis of frame, Design of Secondary beams, main beams, Columns, Beam to Beam, Beam to Column connections, column bases, etc.
3	Design of Truss Bridge: Load estimation, Analysis of truss, Design force for member, Design of Members, Design of connection, Design of cross girder, Drawing.
	B) Field visit and its report.

Oral:

	The oral examination will be based on above term work and course content.

Reference Books:

1	N. Subhramanian, “Design of Steel Structures”, Oxford University Press
2	S. K Duggal, “Limit State Design of Steel Structures”, Tata McGraw-Hill Education
3	S.S.Bhavikatti, “Design of Steel Structures: By Limit State Method”, I K International Pub
4	Dr. Ramchandra, “Limit State Design of Steel Structures”, Scientific Pub
5	M. R. Shiyekar, “Limit State Design in Structural Steel”, Prentice-Hall of India

Reference Codes: Latest editions of following Codes

1	IS:800, “General Construction in Steel - Code of Practice”
2	IS:875-(Part 1 to 5), “Code of Practice for Design Loads for Buildings and Structures”
3	IS:808, “Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections”
4	SP-6(6), “Handbook for Structural Engineers”

Reference Links*:* List of Open-Source Software/learning website:

1	https://www.steel-insdag.org/
2	https://archive.nptel.ac.in/courses/105/105/105105162/

Programme: B. Tech. (Civil) Sem – V (2023 Course)

COURSE: WATER SUPPLY ENGINEERING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs. / Week Practical : 02 Hrs. / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks Term work : 25 Marks Practical : 25 Marks	Theory : 03 Practical : 01
	Total : 150 Marks	Total : 04

Course Pre-requisites: The students should have knowledge of	
1	Engineering Chemistry.
2	Engineering Mathematics.
Course Objective: On completion of the course -	
	to make students aware of Conventional, Advance water treatment and water supply, also about water conservation and water audit along with water modelling software use in field.
Course Outcomes: On completion of the course, the students will be able to -	
1	understand urban water services and water supply systems
2	check drinking water quality and design the process Aeration and Sedimentation.
3	design the process filtration, Disinfection.
4	analyse Water Distribution Networks.
5	estimate water loss and carry out water audit
6	design water distribution networks with the help of Software.

Course Content:

Unit-I	**Overview of Urban Water Management and Demand Forecasting:** Background and Course Introduction, Water Sources and Availability, sustainable water supply, ground water and surface water, Water Uses, Water Supply Key Issues and Concerns, Urban water services and water supply systems, Components of Water Demand, Fluctuations in Water Demand, Concept of Design Period and Design Population Need to Forecast Population, Population Forecasting Methods, Demand Forecasting and Design Capacities. Water Sources and Collection of Water, Surface Water Intakes, Surface Water Intakes Systems.	**(06 Hrs.)**
Unit-II	**Water Quality Management and Treatment Processes:** Water Quality and Water Pollutants, Water Quality Parameters, Philosophy of Water Treatment, Water Treatment Units Screening and Aeration, Water Treatment Units Sedimentation, Practice Problems On Sedimentation, Coagulation and Flocculation: Theory, Coagulation and Flocculation: Selection and Application, Coagulation and Flocculation: Design Operation and Process Control. Theory and design of tube settlers.	**(06 Hrs.)**
Unit-III	**Water Filtration and Advanced Treatment Technologies:** Filtration Theory and Slow Sand Filters, Rapid Sand Filter: Filter Media and Components, Rapid Sand Filters and Pressure Filters, Practice Problems Coagulation-Flocculation and Filtration, Disinfection Basics, Chlorination, Other Disinfection Method: Ozone and UV Disinfection, Advanced and Alternate Treatment Systems, Desalination, Advanced Oxidation Processes and	**(06 Hrs.)**

	Membrane Process.	
Unit-IV	**Water Distribution System:** Basics of Water Distribution System, Water Distribution Networks, Analysis of Water Distribution Networks, Problems on Pipe Flow and Water Distribution Network. Maintenance of water distribution system, Basics of rural water supply treatment and distribution.	**(06 Hrs.)**
Unit-V	**Water Losses in Distribution Systems: Assessment and Control:** Water Losses in Water Distribution System, Water use efficiency, Water Balance for Water Loss Assessment and Performance Indicators, Water Loss Detection and Control, Practice Problems on Water Audit and Water Loss Estimation, Continuous (24*7) water supply systems, District metered area (DMA) for zoning in water distribution networks.	**(06 Hrs.)**
Unit-VI	**Innovative Approaches to Water Distribution: Design, Technology, and Economic Strategies:** Software for water distribution networks design and analysis, Demonstration on EPANET and GEMS, Concept of smart water supply systems, Smart Metering and sensing devices, IoT and Automation in Water Supply, Example of Automation and Smart Water Supply Systems, Example of Automation and Smart Water Supply Systems, Economics of Water Supply Systems, Capital and Operational Cost of Water Supply System, Pricing Waters. Case studies and Practice Problem on Water Pricing.	**(06 Hrs.)**

Term work: The term work shall consist of following (Any Eight)	
1	Determination of pH, total alkalinity and different forms of alkalinity.
2	Determination of total hardness, carbonate hardness and non carbonate hardness.
3	Determination of chlorides.
4	Determination of turbidity and optimum dose of alum.
5	Determination of residual chlorine and optimum does of chlorine.
6	Site visit – Water Treatment Plant.
7	Computer applications - Water Treatment.
8	Computer applications– Analysis of distribution networks.
9	Draw Layout of water supply in residential buildings.
10	Demonstration on EPANET and GEMS.
Practical Examination:	
	The practical examination will be based on above term work and course content.

Reference Books:	
1	BC. Punmia, Ashok Kuamr Jain and Arun Kumar Jain, "Water Supply Engineering", Laxmi Publications (P) Ltd., New Delhi, 1998
2	P.N. Modi, "Water Supply engineering", Standard Book House, Delhi, 1998
3	G.S. Birdie and J.S. Birdie, "Water Supply and Sanitary Engineering", Dhanpat Rai Publishing Company (P) Ltd,. New Delhi, 2002
4	K.N. Duggal, "Elements of Environmental Engineering"' S. Chand and company Ltd.., New Delhi, 1997

5	CPHEEO manual

Reference Codes: Latest editions of following Codes	
1	IS:10500, “Drinking Water quality standards”

Programme: B. Tech. (Civil) Sem – V (2023 Course)

COURSE: TRANSPORTATION ENGINEERING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Construction and Materials
2	Construction Equipment and Methods
Course Objective: On completion of the course -	
	students will develop a comprehensive understanding of Highways, Railways, Airways, Waterways, Tunnels & Bridges.
Course Outcomes: On completion of the course, the students will be able to -	
1	understand the fundamental concepts of transportation engineering.
2	demonstrate the significance of highway engineering.
3	explain the basics and design considerations of railway engineering
4	discuss the aircraft characteristics, planning and components of airport
5	recognize the types and components of docks, ports and harbours.
6	describe the significance of tunnels and bridges in transportation engineering.

Course Content:

Unit-I	**Introduction of Transportation Engineering:** Importance & scope of transportation engineering, role of transportation in economic and social development, Characteristics of various modes of transport, Role of transportation engineers in urban and rural planning, Emerging trends, and challenges in transportation engineering.	**(06 Hrs)**
Unit-II	**Highways:** Characteristics of road transport, scope of highway engineering, highway development in India, necessity of highway planning and development plans, Cross sectional elements, Sight distance, super elevation, Gradient, Highway Alignment: Basic requirements of an ideal alignment and factors controlling.	**(06 Hrs)**
Unit-III	**Railways:** Classification of Railways, Cross section of railway track, Components and Functions of Permanent way, Rails, Sleepers, Ballast, Rail Fastenings: Fish Plates, Bearing Plates, Spikes, Keys, Points and crossings, Railway stations and yards, Signaling and interlocking - control systems of train movements.	**(06 Hrs)**
Unit-IV	**Airways:** Aircraft characteristics, Airport Classification and Components, Airport Site Selection Criteria, Runway Orientation and Wind Rose Diagram, Runway Design – ICAO & FAA Guidelines, Airport obstructions and zoning, Terminal area planning, Runway, taxiways, and aprons.	**(06 Hrs)**

Unit-V	**Waterways:** Introduction to Water Transport and its Importance, Classification of Ports and Harbours, Site Selection for Ports and Harbours, Harbour Layout and Components, Dock Types – Wet Docks, Dry Docks, and Floating Docks, Port Facilities – Cargo Handling, Storage, and Warehousing, Inland Waterways and Coastal Shipping.	**(06 Hrs)**
Unit-VI	**Tunnel & Bridges:** Definition of tunnel, Role of tunnels in transportation, Types of Tunnels, Methods of tunneling, Safety Standards & Regulations. Definition of Bridge, Importance & Functions of Bridges, Types of Bridges, economic span of bridges.	**(06 Hrs)**

Reference Books:	
1	S.K.Khanna, C.E.G. Justo, "Highway Engineering", 10th Edition, Nem Chand and Bro.
2	S.C.Saxena, S.P.Arora, "A Text Book of Railway Engineering", Dhanpat Rai Publications.
3	S.K.Khanna, M.G.Arora, S.S.Jain, "Airport Planning and Design", Nem Cahnd and Bros.
4	S.P.Bindra, "A Course in Docks and Harbour Engineering", Dhanpat Rai Publications.
5	S.K. Sharma, "Docs and Harbour", McGraw Hill.
6	S.C. Saxena, "Tunnel Engineering", Dhanpat Rai Publications.
7	C.J.Khisty and Lall B.K., "Transportation Engineering: An Introduction", 3rd Edition, Pearson Publications
8	J.S.Mundrey, "Railway Track Engineering", Tata McGraw Hill, New Delhi.
9	Vicksburg, "Coastal Engineering Manuals Volume I and II", US Army Corps of Engineers.
Reference Codes: The latest versions of the codes	
1	IRC 37: Guidelines for the design of flexible pavements
2	IRC 58: Guidelines for the design of rigid pavements
3	Specifications for Road and Bridge works (MORTH)-IRC, New Delhi.
4	IS 4651: Code of Practice for Planning and Design of Ports and Harbours
5	Indian Railway Standards (IRS)
6	International Civil Aviation Organization (ICAO)
7	Federal Aviation Administration (FAA)
Reference Links: List of Open-Source Software/learning website:	
1	https://archive.nptel.ac.in/courses/105/107/105107123/

Programme: B. Tech. (Civil) Sem – V (2023 Course)

COURSE: QUANTITY ESTIMATION AND VALUATION		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week Practical : 02 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks Term work : 25 Marks Oral : 25 Marks	Theory : 03 Practical : 01
	Total : 150 Marks	Total : 04

Course Pre-requisites: The students should have knowledge of	
1	Building Planning and Design
2	Advanced Surveying with Geomatics
3	Project Management
4	Infrastructure and Transportation Systems
5	Limit State Design of Steel Structures
Course Objective: On completion of the course -	
	the students will be able to prepare the students to make an estimate of building, road and other civil engineering structures.
Course Outcomes: On completion of the course, the students will be able to -	
1	determine approximate estimate of structures.
2	workout detailed estimates for various construction projects.
3	define specification with reference to different types of materials.
4	determine rates for different construction activities.
5	prepare bill of quantities.
6	perform valuations of properties using different methods.

Course Content:

Unit-I	**Introduction to Estimating and Costing:** Purpose & Importance of Estimating and Valuation, Types of Estimates: Preliminary, Detailed, Revised, Supplementary, Approximate, Cube rate, Plinth area, and Lump sum estimates, Data required for estimates (drawings, specifications, market rates), Units of measurement and their principles, Mode of measurement for various building works, Schedule of Rates (D.S.R.) & Market Rate Analysis,	**(06 Hrs)**
Unit-II	**Methods of Taking out Quantities:** Long Wall-Short Wall method, Centre Line method, Detailed Estimation of: Single-Storey & Multi-Storey Buildings, Different RCC Members (Beams, Slabs, Columns, Footings, etc.), Water Supply & Sanitary Works, Culverts, Bridges & Road Works, Earthwork Estimation for Roads & Canals, Structural Estimation (Trusses, Steel Structures, etc.), Application of IS Codes in Estimating. Calculating quantities using MS Excel.	**(06 Hrs)**

Unit-III	**Specifications:** Definition, purpose, and importance of specifications, Types of Specifications: General, Detailed, Performance-Based, Standard Specifications for Various Works, Drafting Specifications for Major Works: Earthwork, Brick & Stone Masonry, Plastering & Tiling, Concrete & RCC Works, Structural Steel Works, Integration of Green Building Specifications.	**(06 Hrs)**
Unit-IV	**Rate Analysis:** Purpose & Importance of Rate Analysis, Factors Affecting Rate Analysis, Labor and material requirements for different works, Overhead expenses and profit margins, Procedure for Rate Analysis, Rate Analysis of: Earthwork, Masonry, Plastering, Flooring, RCC & Structural Steel Works.	**(06 Hrs)**
Unit-V	**Abstracting and Billing:** Purpose & Preparation of Abstracts, Measurement & Billing Procedures, Types of Bills: Running & Final Bills, Checking of Bills & Finalization, Maintenance of muster role, Billing Processes for Contractors, Measurement of work for payment of contractors, Use of Digital Billing Software (Tally, ERP, HIT-Office, SAP, etc.).	**(06 Hrs)**
Unit-VI	**Valuation of Buildings & Infrastructure:** Purpose & Nature of Valuation, Valuation Terms: Price, Cost, Value, Freehold & Leasehold Property, Factors affecting property value, Concepts of freehold and leasehold property, Depreciation & Methods of Depreciation Calculation, Sinking Fund & Its Importance in Valuation, Years' Purchase & Outgoings Considerations, Methods of Valuation: Land and building method, rental method, replacement cost method, market value & Comparative analysis, Valuation reports and their components.	**(06 Hrs)**

Term work: The term work shall consist of following practical-(ANY EIGHT)	
1	Prepare a detailed estimate using the Long Wall-Short Wall and Centre Line methods.
2	Detailed estimate of a single storied RCC framed building using D.S.R. rates.
3	Calculate the material and cost estimation for Septic Tank, Roadways, Culverts
4	Estimate the quantities of concrete, steel, and formwork required for beams, slabs, columns, and footings.
5	Encourage students to gather real-time material and labour rates rather than relying solely on DSR.
6	Draft detailed specifications of any five items of work.
7	Perform rate analysis for key construction items like brick masonry, concrete, plastering, painting, electrical work, flooring, waterproofing and RCC work.
8	Develop a BOQ for a given construction project.
9	Determine the depreciation and value of a building using different methods.
10	Use Excel formulas for automated cost estimation and report generation.
Oral:	
	The oral examination will be based on above term work and course content.

Reference Books:	
1	B.N. Dutta “Estimating and Costing in Civil Engineering Theory and Practice” UBS Publishers & Distributors
2	M. Chakraborti “Estimating, Costing, Specification & Valuation in Civil Engineering” Chakraborti Publication
3	G.S. Birdie “Estimating and Costing for Civil Engineering” Dhanpat Rai Publishing Company.
4	P.L. Bhasin “Quantity Surveying: Estimating and Costing” S. Chand Publishing.
5	S.C. Rangwala “Estimating and Costing in Civil Engineering” Charotar Publishing House
6	V.N. Vazirani & S.P. Chandola “Quantity Surveying and Valuation” Khanna Publishers
7	L.N. Gupta “Principles of Estimation and Costing” Standard Publishers Distributors
8	Late P.T. Joglekar, “Practical Information for Quantity Surveyors” Pune Vidharthi Griha Prakashan.
Reference Codes: The latest versions of the codes	
1	IS 1200 (Part 1 to 28) – Method of Measurement of Building and Civil Engineering Works
2	IS 3385:1965 – Code of Practice for Measurement of Works in Construction
3	IS 7272 (Part 1 & 2):1974 – Recommendations for Labour Output Constants
Reference Links: List of Open-Source Software/learning website**:**	
1	https://nptel.ac.in
2	https://librecad.org
3	https://www.coursera.org
4	https://skill-lync.com
5	https://openconstructionacademy.com

Programme: B. Tech. (Civil) Sem – V (2023 Course)

SKILL BASED COURSE -V: COMPUTER AIDED ESTIMATION AND COSTING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Practical : 2 Hrs / Week	Termwork : 25 Marks Practical : 25 Marks	Practical : 01
	Total : 50 Marks	Total : 01

Course Pre-requisites: The students should have knowledge of	
1	Building Planning and Design
2	Advanced Surveying with Geomatics
3	Project Management
4	Infrastructure and Transportation Systems
5	Limit State Design of Steel Structures
Course Objective: On completion of the course -	
	The students will be able to computer application for efficient quantity estimation and valuation in civil engineering projects.
Course Outcomes: On completion of the course, the students will be able to -	
1	estimation quantities using computer application.
2	develop rate analysis templates using computer program.
3	use software tools for e-tendering and cost estimation.

Course Content:

Unit-I	**Quantity Estimation using Computer Application:** Computer application for the estimation of quantity: line, area and volume- Earthwork & excavation, concrete work, flooring, painting and plastering & land surveying,brickwork,steel requirement.road construction, water pipes,fencing.	**(08 Hrs)**
Unit-II	**Rate Analysis using Computer Application:** Computer application for the rate analysis of different items of work: PCC, RCC work in brickwork, concrete, plastering, painting, flooring, waterproofing, and electrical.	**(08 Hrs)**
Unit-III	**E-Tendering: -** Basic concepts of tendering, including e-tendering and manual tendering. , Differences between e-tendering and manual tendering, Understanding contract terms and conditions in tendering processes, Registration as a contractor and the process of obtaining civil contractor licenses, Data and tools required for e-tender filling, tender searching, and documentation, E-tender filling process and digital contract management.	**(08 Hrs)**

Term work: The term work shall consist of **ANY EIGHT** following practical-	
1	Prepare a detailed estimate for a single-story or multi-story residential building using computer application.
2	Develop spreadsheet templates for length, area, and volume calculations.
3	Estimate the cost of a water supply scheme or roadway using spreadsheet software, incorporating cost optimization techniques.
4	Perform rate analysis for brick masonry using market rates and IS code labour constants,

	presenting results with charts and graphs.
5	Perform rate analysis using computer application for key construction items excavation brickwork, concrete, plastering, painting, flooring, waterproofing, electrical.
6	Conduct depreciation analysis and valuation of a building using computer application.
7	Students will be assigned to search for live tenders on a government e-procurement portal (e.g., GeM, state-specific portals).
8	Develop computer application templates for running and final bills, including columns for measurement details, quantities, rates, and amounts.
9	Using a demo or training version of an e-procurement portal (if available) or by using screenshots of a real portal, students will simulate the process of filling an e-tender.
10	Conduct a mini-project using computer application to analyze data from a live construction site.
Practical:	
	The Practical examination will be based on the above term work and course content.
Reference Books:	
1	B.N. Dutta "Estimating and Costing in Civil Engineering Theory and Practice" UBS Publishers & Distributors
2	M. Chakraborti "Estimating, Costing, Specification & Valuation in Civil Engineering" Chakraborti Publications
3	S.C. Rangwala "Estimating and Costing in Civil Engineering" Charotar Publishing House
4	L.N. Gupta "Principles of Estimation and Costing" Standard Publishers Distributors
Reference Codes: The latest versions of the codes	
1	IS 1200 (Part 1 to 28) – Method of Measurement of Building and Civil Engineering Works
2	IS 3385:1965 – Code of Practice for Measurement of Works in Construction
3	IS 7272 (Part 1 & 2):1974 – Recommendations for Labour Output Constants
Reference Links: List of Open-Source Software/learning website**:**	
1	NPTEL Online Courses
2	LibreCAD - Open-Source CAD
3	Coursera - Civil Engineering Courses

Programme:
B. Tech. (Civil)-2023
Sem – VI

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

COURSE: DESIGN OF REINFORCED CONCRETE STRUCTURES		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs. / Week Practical : 02 Hrs. / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks Term work : 25 Marks Oral : 25 Marks	Theory : 03 Practical : 01
	Total : 150 Marks	Total : 04

Course Pre-requisites: The students should have knowledge of	
1	Engineering Mechanics
2	Building Planning and Design
3	Mechanics of Solids
4	Concrete Technology
5	Structural Analysis
Course Objective: On completion of the course -	
	the student should be able to complete the design and detailing of a G+2 storey R.C.C. building.
Course Outcomes: On completion of the course, the students will be able to	
1	differentiate between various design philosophies and apply Limit State design philosophy.
2	determine moment of resistance of beam section.
3	design and detail the different types of slabs and staircases.
4	design and detail the beams for flexure, and shear for various supporting conditions.
5	design and detail the short columns for axial load, uniaxial and biaxial bending.
6	design and detail the column footing.

Course Content:

Unit-I	**Materials and Design Approach:** Introduction of Reinforced Cement Concrete (RCC): Materials: Types of reinforcements, Study of properties of concrete and properties of steel. Introduction to design philosophies of R.C. Structures: Working Stress Method, Limit State Method. Characteristics strength and design strength, idealized stress-strain curve for materials, Partial safety factors for materials and loads, Loads and load combinations.	**(06 Hrs.)**
Unit-II	**Reinforced Concrete Sections in Flexure:** Limit State Method: Concept of balanced, under reinforced, and over reinforced section; Design parameters, Design of singly, doubly reinforced rectangular and flanged sections.	**(06 Hrs.)**
Unit-III	**Design of Slab:** Design of one-way slab: Simply supported, Cantilever, and Continuous slabs. Design of two way slab: Simply supported, Continuous and restrained. Provision of torsion reinforcement. Design of staircase: Dog legged.	**(06 Hrs.)**
Unit-IV	**Design of Beam:** Design of beams for flexure, shear, bond: Simply supported, continuous and cantilever, Redistribution of moments in beams	**(06 Hrs.)**

Unit-V	**Design of Column:** Requirements of minimum eccentricity, Design of short columns for axial load, uniaxial and biaxial moments.	**(06 Hrs.)**
Unit-VI	**Design of Footing:** Design of column footing for axial load and moments.	**(06 Hrs.)**

Termwork: The term work shall consist of-	
1	Design of G + 2 (residential/commercial/public) storey building having minimum floor area of 150 m^2 (for gravity loads only). The design should include all types of slabs, beams, columns, footings and staircase (first and intermediate flight). **Note: Maximum five students in a group and each group should have different design data.**
2	Four full imperial drawing sheets.
3	Detailing of reinforcement should be as per SP-34 & IS-13920.
4	Report of a site visit to building under construction.
Oral:	
	The oral examination will be based on above term work and course content.
Reference Books:	
1	Dr. Shah V. L. & Dr. Karve S. R., "Limit State Theory and Design", Pune Vidyarthi Griha.
2	Punmia, Jain & Jain, "Comprehensive Design of R. C. Structures", Standard Book House.
3	Bhavikatti S. S., "Design of R.C.C. Structural Elements", New Age International Ltd.
4	Dayaratnam P., "Limit State Analysis and Design", Wheeler Publishing Company, New Delhi.
5	Vergese P. C., "Limit State Design", Prentice Hall India Publications, New Delhi.
6	Sinha R.C., "RCC Analysis and Design- Vol. I, II", Chand and Co, New Delhi Publications.
7	Subramanian N., "Design of Reinforced Concrete Structures", Oxford University Press.
8	Fergusson M., "R. C. Fundamentals", Tata McGraw Hill Publication.
9	Pillai S. Unnikrishnan, & Menon Devidas, "Reinforced Concrete Design", Tata McGraw Hill Publication.
10	Dr. Shah H. J., "Reinforced Concrete -Vol.1 (Elementary Reinforced Concrete)", Charotar Publications.
Reference Codes: The latest versions of the codes	
1	IS 456: Plain and Reinforced Concrete-Code of Practice.
2	IS 875: (Part I to V): Code of Practice for Design Loads.
3	IS 13920: Ductile Design and Detailing of Reinforced Concrete Structures subjected to Seismic Forces.
4	SP 16: Design Aids for Reinforced Concrete.
5	SP 34: Handbook on Concrete Reinforcement and Detailing.
Reference Links: List of Open Source Software/learning website:	
1	https://nptel.ac.in/courses/105105105
2	https://nptel.ac.in/courses/105106224

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

COURSE: WASTEWATER ENGINEERING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs. / Week Practical : 02 Hrs. / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks Term work : 25 Marks Oral : 25 Marks	Theory : 03 Practical : 01
	Total : 150 Marks	Total : 04

Course Pre-requisites: The students should have knowledge of	
1	Engineering Chemistry
2	Engineering Mathematics
3	Mechanics of fluids
4	Microbiology
Course Objective: On completion of the course -	
	to understand the basics of waste water treatment.
Course Outcomes: On completion of the course, the students will be able to -	
1	apply concept related to sewage, sewer, storm water, etc in its hydraulic design.
2	evaluate sewerage system and assess characteristics of sewage.
3	study wastewater disposal systems and understand preliminary and primary treatment of sewage.
4	design secondary treatment methods.
5	design septic tank and imhoff tank.
6	suggest sludge treatment and disposal.

Course Content:

Unit-I	**Design and Analysis of Wastewater Flow and Sewer Systems:** Wastewater- Sources and flow rates, Domestic wastewater, Estimation of quantity of wastewater, Dry weather flow, storm water flow, Time of concentration. Sewers, Design of circular sewers under full and partial flow conditions.	**(06 Hrs.)**
Unit-II	**Study of Sewer Appurtenances, Sewerage Systems, and Sewage Characteristics:** Sewer appurtenances-Man holes, catch basin, flushing devices, Inverted siphon. Ventilation of sewers. Sewage, Sewerage Systems Sewage characteristics- Physical, chemical and biological parameters, Biochemical oxygen demand, first stage BOD, Chemical oxygen demand, Relative stability, Population equivalent.	**(06 Hrs.)**
Unit-III	**Wastewater Disposal and Primary Treatment:** Waste water disposal systems- Self-purification of streams, Dilution-Oxygen sag curve, Streeter Phelp's Equation, land treatment. Treatment of sewage-Preliminary and Primary treatment -Theory and design of Screen, Grit chamber, Detritus chamber, Flow equalization tank and Sedimentation tank.	**(06 Hrs.)**

Unit-IV	**Secondary and tertiary treatment methods:** Secondary treatment methods- Theory and design of Trickling filter, Trickling filter-High rate, standard. Rotating biological contactor Theory and design of Activated sludge process, modifications in activated sludge process, SBR, MBR Tertiary Treatment of sewage. Methods of Disposal of treated Effluent, effluent disposal standards. water pollution and control act.	**(06 Hrs.)**
Unit-V	**Design and Operational Principles of On-Site and Advanced Wastewater Treatment Systems:** Theory and design of Septic tank and Imhoff tank, Principle and working of Oxidation ditch and oxidation ponds. Aerated lagoons, Theory and principle of upflow anaerobic sludge blanket reactors. Recycle and reuse of treated wastewater.	**(06 Hrs.)**
Unit-VI	**Sludge treatment and disposal:** Methods of thickening, Sludge digestion- Anaerobic digestion, Design of sludge digestion tanks and Sludge drying beds, methods of sludge disposal.	**(06 Hrs.)**

Term work: The term work shall consist of following (Any Eight) -	
1	Determination of Solids –Total solids, suspended solids, volatile solids, settleable solids& non settleable solids
2	Determination of Dissolved oxygen
3	Determination of Bio-Chemical Oxygen Demand
4	Determination of Chemical Oxygen Demand
5	Determination of Electrical Conductivity
6	Determination of Phosphates by spectrophotometer
7	Determination of Nitrates by spectrophotometer
8	Determination of Sludge Volume Index
9	Design of ETP/STP
10	Visit to domestic / Industrial wastewater treatment plant & its detailed reports
Oral:	
	The oral examination will be based on above term work and course content.

Reference Books:	
1	Metcalf and Eddy,(Revised by G. Tchobanoglous) Wastewater Engineering & Treatment, disposal Reuse, Tata-McGraw Hill, New Delhi
2	A.P. Sincero and G.A. Sincero, Environmental Engineering, Prentice Hall of India, New Delhi.
3	H.S. Peavy, D.R. Rowe and G. Tchobanoglous, Environmental Engineering, McGraw Hill International Edition.
4	G.S. Birdie and J.S. Birdie, Water Supply and Sanitary Engineering, Dhanpat Rai Publishing Co. New Delhi.
5	B.C Punmia , “Waste Water Engineering”, Laxmi Publications Pvt. Ltd, 2012
6	J. Arceivala, Shyam R. Asolekar, Wastewater Treatment for Pollution Control and Reuse, McGrawhill Education, 2007
7	CPHEEO manual

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

COURSE: ADVANCED TRANSPORTATION ENGINEERING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week Practical : 02 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks Term work : 25 Marks	Theory : 03 Practical : 01
	Total :125 Marks	Total : 04

Course Pre-requisites: The students should have knowledge of	
1	Construction and Materials
2	Construction Equipment and Techniques
3	Transportation Engineering
Course Objective: On completion of the course -	
	Students will be able to plan and design highways following standard codes and understand the significance of urban transport technologies.
Course Outcomes: On completion of the course, the students will be able to -	
1	design the transport systems by conducting various surveys.
2	analyze various materials used in highway construction.
3	design the flexible and rigid pavements.
4	implement the urban transport technologies.
5	demonstrate the process of highway construction, highway drainage and its maintenance.
6	describe the construction and functioning of Metro Rail Systems.

Course Content:

Unit-I	**Transportation Planning:** Traffic characteristics-road user characteristics, vehicular characteristics, Passenger Car Unit (PCU), Level of Service (LOS), Traffic studies-speed, volume, speed and delay, origin destination, parking, and accident studies; capacity of urban roads and highways.	**(06 Hrs)**
Unit-II	**Pavement Materials:** Importance and properties of sub-grade, pavement component materials, Aggregates, Tests on aggregates, Types of Bituminous materials- cut back, tar, emulsion, and tests on bitumen.	**(06 Hrs)**
Unit-III	**Design of Pavement:** Objects and requirements, Types of pavements structures, Functions of pavement components, Factors affecting pavement design, Design of flexible pavement by C.B.R. Method, IRC 37- guidelines, Design of rigid pavements, IRC 58- Design guidelines, Introduction to mechanistic designs.	**(06 Hrs)**
Unit-IV	**Highway Construction, Drainage & Maintenance:** Highway Construction: Construction of various types of roads, Joints in cement concrete pavements. Highway Drainage: Significance of drainage, Requirements of drainage, Surface Drainage, Sub-surface Drainage. Highway Maintenance: Causes of failure of road pavements, Maintenance of rigid and flexible pavements.	**(06 Hrs)**

Unit-V	**Urban Transportation Technologies:** Bus transit, Mass Rapid Transit System- Metro rail, Mono rail, Intelligent Transportation Systems (ITS), Urban Air Mobility, Bullet Train, Transit Oriented Development (TOD), Integrated Multi modal Transport System, Toll Management Systems.	**(06 Hrs)**
Unit-VI	**Metro Rail System:** Introduction to Urban Rail Systems and Metro Rail Projects, Need for Metro Rail in Urban Transportation, Metro Rail Planning and Route Alignment, Track Structure for Metro Systems – At Grade, Elevated, and Underground Sections, Rolling Stock and Traction System in Metro Rail, Signaling and Train Control Systems, Case Studies of Metro Rail Systems in India and Worldwide.	**(06 Hrs)**

Term Work: The term work shall consist of	
1	Tests on Aggregate (Any Four):
	a. Aggregate Impact Value Test
	b. Aggregate Crushing Strength Test
	c. Shape Test (Flakiness Index and Elongation Index)
	d. Los Angeles Abrasion Test
	e. Specific Gravity and Water Absorption Test by basket method
	f. Stripping Value Test
2	Tests on Bitumen (Any Three):
	a. Penetration Test
	b. Ductility Test
	c. Softening Point Test
	d. Specific Gravity Test
	e. Bitumen Emulsion Test
3	Urban Transport Technology:
	a. Site Visit
Oral:	
	The oral examination will be based on above term work and course content.

Reference Books:	
1	S.K.Khanna, C.E.G. Justo, “Highway Engineering”, 10th Edition, Nem Chand and Bro.
2	L. R. Kadiyali, “Traffic Engineering and Transport Planning”, Khanna Publishers.
3	C.J.Khisty and Lall B.K., “Transportation Engineering: An Introduction”, 3rd Edition, Pearson Publications
4	Y.H. Huang, “Pavement Analysis and Design”, 2nd edition, Pearson Publication
5	E.J.Yoder, “Principals of Pavement Design”,2nd Edition, Wiley Publication.
6	C.J.Khisty and Lall B.K, “Transportation Engineering: An Introduction”, 3rd Edition, Pearson Publication.
7	M.M. Agarwal, S.Chandra and K.K. Miglani “Metro Rail in India for Urban Mobility”, Prabha & Co.

Reference Codes: The latest versions of the codes	
1	IRC 37: Guidelines for the design of flexible pavements
2	IRC 58: Guidelines for the design of rigid pavements
3	Specifications for Road and Bridge works (MORTH)-IRC, New Delhi.
Reference Links: List of Open-Source Software/learning website:	
1	https://archive.nptel.ac.in/courses/105/106/105106221/

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

COURSE: WATER RESOURCES ENGINEERING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Fundamentals of Civil Engineering
2	Fundamental of Surveying
Course Objective: On completion of the course -	
	the students will be able to analyze rainfall data and calculate runoff and workout reservoir planning.
Course Outcomes: On completion of the course, the students will be able to -	
1	analyse the precipitation data.
2	calculate runoff.
3	estimate water requirements of crops.
4	workout reservoir planning.
5	examine dams and allied structures.
6	design of hydropower plant and river training works.

Course Content:

Unit-I	**Analysis of Precipitation Data, Infiltration, Evaporation** Types and measurement of Precipitation, Errors and Estimating missing rainfall data, Intensity Duration Frequency Curves (IDF), Probable Maximum Precipitation Curves (PMP), Infiltration and Evapotranspiration.	**(06 Hrs.)**
Unit-II	**Runoff and its Computations** Factors Affecting runoff, Unit Hydrograph, Computations of Runoff using Runoff Coefficients, Infiltration Capacity Curves, Infiltration Indices, SCS-CN method for estimating runoff volume of a catchment.	**(06 Hrs.)**
Unit-III	**Water Requirements of Crops & Canal Irrigation** Crop Period, Base Period, Duty and Delta of a Crop, Irrigation Efficiencies, Consumptive Use, Net Irrigation Requirement, Soil Moisture Irrigation Relationships, alignment of Canals, Distribution systems for canal irrigation, canal losses, canal lining.	**(06 Hrs.)**
Unit-IV	**Reservoir Planning** Reservoir Types, Investigation for reservoir planning, various storage zones, area capacity curve, area elevation curves, estimation of storage by mass curve method, Reservoir sedimentation, Causes, effects and controlling measures, trap efficiency, inflow / capacity ratio, life of reservoir, Methods for estimation of sediment yield from watershed.	**(06 Hrs.)**
Unit-V	**Dams and Allied Hydraulic Structures** Introduction, types of dams, suitability, design parameters, causes of failure of dams, spillway types, headworks.	**(06 Hrs.)**

Unit-VI	**Hydropower & River training works** Introduction, comparison with other alternatives, classification, components of hydropower plants – H.R.T., T.R.T. surge tanks, penstocks, water requirement for hydropower, flow duration curve, selection of turbines River training works, Introduction, objectives, classification of river training works, design parameters.	**(06 Hrs.)**

Reference Books:	
1	H.M. Raghunath; 'Engineering Hydrology Principles, Analysis Design', New Age International Publications.
2	K Subramanya; 'Engineering Hydrology', Mc Graw Hill
3	Dr. P. Jaya Ram Reddy; 'A Textbook of Hydrology', University Science Press
4	Dr. B. C. Punmia, 'Irrigation & Waterpower Engineering', Laxmi Publications (P) Ltd.
5	M M Dandekar; 'Waterpower Engineering', Vikas Publishing House Pvt. Ltd.
Reference Codes*:* The latest versions of the codes	
1	IS 7365, "Criteria for hydraulic design of bucket type energy dissipaters"
2	IS 4997, "Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron"
3	IS 6512, "Criteria for Design of Solid Gravity Dam"
4	IS 6934, "Hydraulic design of high ogee overflow spillways"
5	IS 10137, "Guidelines for Selection of Spillways and Energy Dissipators"
6	IS 11223, "Guidelines for Fixing Spillway Capacity"
7	IS 10430, "Design of Lined Canals"
8	IS 7112, "Design of Unlined Canals"
9	IS 4849, "Meteorology — Rain Measures —Specification"
10	IS 4986, "Installation of Rain gauge (Non-Recording Type) and Measurement of Rain - Code of Practice"
Reference Links: List of Open Source Software/learning website:	
1	https://onlinecourses.nptel.ac.in/noc23_ce44/preview
2	https://www.udemy.com/topic/hydrology/?srsltid=AfmBOorDIv_1fzBrtNXqfe9PG0FmZ_1BjkgcSq1mkuLVx-VhOnMMDpDK
3	https://ocw.mit.edu/courses/1-72-groundwater-hydrology-fall-2005/
4	https://www.classcentral.com/report/best-hydrology-courses/
5	https://www.udemy.com/course/basic-hydrology/?srsltid=AfmBOooFDs-UuHgdu2bFrmoKmzXAL-wnIpgjaeXGiZOhLR77xjhQVyQj

PROGRAM ELECTIVE- I

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

PROGRAM ELECTIVE-I: - ADVANCED CONCRETE TECHNOLOGY		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hours / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Concrete Technology
Course Objective: On completion of the course -	
	the students should be able to comprehend advanced topics in concrete technology, including specialized concrete materials, innovative production methods, and analyze advanced testing and characterization techniques.
Course Outcomes: On completion of the course, the students will be able to -	
1	decide additives and admixtures for concrete.
2	select suitable types of concrete for different works.
3	use suitable material for sustainability.
4	implement advanced mixing techniques, innovative placement and finishing techniques.
5	apply advanced concrete testing techniques.
6	adopt emerging trends and technologies in advanced concrete materials

Course Content:

Unit-I	**Introduction:** Ingredients of concrete, Properties of cement,Additives and Admixtures in Concrete,Rheology of Concret, Creep and shrinkage,Grading curves.	**(06 Hrs.)**
Unit-II	**Specialized Concrete - Properties & Applications:** Self-Consolidating Concrete (SCC), Fiber-Reinforced Concrete (FRC),Jet Cement Concrete & Ultra Rapid Hardening Concrete, Gap Graded Concrete, Waste Material Based Concrete, Shotcrete & Guniting, Polymer Concrete.	**(06 Hrs.)**
Unit-III	**Sustainable Concrete Materials:** Green Concrete: definition, benefits, and challenges.Recycled Aggregate Concrete: properties, applications, and benefits. Supplementary Cementitious Materials (SCMs): types, properties, and applications.	**(06 Hrs.)**
Unit-IV	**Innovative Production Methods:** Advanced Mixing Techniques (e.g. rheology, mixing simulations).Innovative Placement and Finishing Techniques (e.g., pumping, spraying, 3D printing, Robotic finishing).Prefabricated Concrete Elements.	**(06 Hrs.)**
Unit-V	**Advanced Testing and Characterization Techniques:** Non-destructive Testing (NDT) Methods (e.g. ultrasonic testing, radiography). Microstructural Analysis (e.g. SEM, XRD). Mechanical Testing (e.g. compressive strength, tensile strength).	**(06 Hrs.)**

Unit-VI	**Future Directions and Challenges:** Emerging Trends and Technologies in Advanced Concrete Materials. Challenges and Limitations in the Development and Application of Advanced Concrete Materials.Future Research Directions and Potential Applications of Advanced Concrete Materials.	**(06 Hrs.)**

Reference Books:	
1	M. S. Shetty, "Concrete Technology", S. Chand Publication.
2	R. N. Swamy, "Concrete Technology & Design" Surrey University Press.
3	Rafal Siddique, "Special Structural Concretes", Galgotia Publication Pvt. Ltd. New Delhi
4	P. N. Balaguru, S. P. Shah, "Fiber Reinforced Cement Composites" McGraw Hill Publication.
5	John Newman and Ban Seng Choo "Advanced Concrete Technology", Butterworth-Heinemann.
6	Neville, A.M., "Properties of Concrete", 3rd Edition, Longman Scientific and General.
7	Shanta Kumar A.R., Concrete Technology, 2 nd Edition, Oxford University Press, New Delhi,
8	Neville, A.M. and Brookes, J.J., "Concrete Technology", 2nd Edition, Pearson Education.
9	Krishna Raju. N, "Design of Concrete Mixes", 2nd Edition, CBS Publishers and Distributors.
10	Gambhir, M.L., "Concrete Technology", 2nd Edition, Tata McGraw Hill Publishers, New Delhi.
11	P. Kumar Mehta and Paulo J.M. Monteiro "Concrete: Microstructure, Properties, and Materials", McGraw-Hill Publication.
12	D. J. Hannant, "Fiber Cement and Fiber Concrete" John Wiley and Sons Publication.
13	Bhusan L. Karihal, "Fracture Mechanics and Structural Concrete", John Wiley and Sons Publications.
Reference Codes*:* The latest versions of the codes	
1	IS 10262: Indian Standard code of practice for Guidelines for concrete mix proportioning,Bureau of Indian Standards, New Delhi.
2	ACI PRC-237-07 Self-Consolidating Concrete.
3	ACI 549.1R-18 Design Guide for Ferro-cement.
4	IS 15388: Specification for Silica Fume.
5	ACI PRC-548.1-09: Guide for the Use of Polymers in Concrete.
6	ACI 211.2-98 Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

PROGRAM ELECTIVE-I: CONSTRUCTION MANAGEMENT		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory :03Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Building Construction
2	Building Planning, Design, and Byelaws
3	Economics and Finance
4	Project Management
Course Objective: On completion of the course -	
	the students will be able to apply Construction Management knowledge during the execution of civil engineering structures.
Course Outcomes: On completion of the course, the students will be able to -	
1	know the role, duties, and responsibilities of a construction manager in contemporary projects.
2	conduct economic comparisons of projects using modern financial analysis tools.
3	apply linear programming techniques for optimization of civil engineering problems.
4	use AI tools for decision making and automation.
5	adhere to laws to the construction industry.
6	implement safety protocols

Course Content:

Unit-I	**Introduction to Modern Construction Management:** Nature, characteristics, and evolution of the construction sector globally and in India, Role of construction in economic development and sustainability, Construction Management: Importance, necessity, characteristics, and functions in the 21st century. Construction Manager: Qualities, ethics, duties, authorities, responsibilities, and continuous professional development. Introduction to sustainable construction practices.	**(06 Hrs)**
Unit-II	**Engineering Economics and Financial Management:** Time value of money, cash flow analysis, and financial modeling, Modern cost estimation and control techniques, Economic comparisons of projects: Discounted cash flow analysis, Net Present Worth Method, Internal Rate of Return Method, and benefit-cost ratio, Risk management and financial risk assessment, Introduction to Building Information Modelling (BIM) for cost estimation.	**(06 Hrs)**
Unit-III	**Optimization and Resource Management**: Linear programming models: Transportation and assignment problems-Northwest Corner Method, Least Cost Method, Vogel's Approximation Method (VAM), Hungarian Method, Game Theory and its Applications in Construction., Simulation techniques in construction management, Introduction to lean construction principles.	**(06 Hrs)**

Unit-IV	**Digital Technologies and Artificial Intelligence (AI) in Construction:** Artificial Neural Networks, Fuzzy Logic, and Machine Learning applications in construction, Use of drones, robotics, and automation in construction, Data analytics and predictive modeling for project management, Use of cloud-based collaboration software.	**(06 Hrs)**
Unit-V	**Construction Labour, Legislation, and Contracts:** Modern labour laws and regulations: Contract Labour Act, Workmen Compensation Act, Minimum Wages Act, etc., Construction contracts and dispute resolution, International Labour standards and ethical considerations, Emphasis on worker rights and fair labor practices, Occupational safety and health administration (OSHA) standards.	**(06 Hrs)**
Unit-VI	**Construction Safety and Site Management:** Advanced safety management systems and risk assessment, Implementation of safety protocols and emergency response plans, Use of personal protective equipment (PPE) and safety technologies, Site layout planning and optimization for efficiency and safety, Environmental impact assessment and mitigation, Implementation of sustainable site practices, Site visit.	**(06 Hrs)**

Reference Books:

1	S. Seetharaman "Construction Engineering and Management" Umesh Publications, Delhi.
2	L.C. Jhamb "Quantitative Techniques for Managerial Decisions" Everest Publishing House, Pune.
3	K.K. Chitkara "Construction Project Management" Tata McGraw Hill, New Delhi.
4	Edward R. Fisk "Construction Project Administration" Prentice Hall, USA.
5	O.P. Khanna "Industrial Engineering and Management" Dhanpat Rai Publications, New Delhi.
6	Barrie Paulson "Professional Construction Management" Tata McGraw Hill, New Delhi.

Reference Codes*:* The latest versions of the codes

1	IS 3385:1965 – Code of Practice for Measurement of Works in Construction
2	IS 7272 (Part 1 & 2):1974 – Recommendations for Labour Output Constants

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

PROGRAM ELECTIVE-I: SOLID WASTE MANAGEMENT		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs. / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Environmental Chemistry, microbiology
2	Mathematics
Course Objective: On completion of the course -	
to learn the mode of Solid Waste Generation and understand its need and importance to Reuse,ecycle, Refuse and thereby, effectively manage the problem of Solid Waste generated as well as mitigation and combating the issue of land pollution	
Course Outcomes: On completion of the course, the students will be able to -	
1	understand the generation, sources and characteristics of Solid Waste
2	explain types of solid wastes
3	describe the different steps of executing the relevant methods of solid waste disposal
4	learn Segregation, Collection and Transportation of Municipal Solid Waste (MSW)
5	familiarize with Circular Economy in context of Solid Waste
6	assess the risk involved in solid waste management

Course Content:

Unit-I	**Introducing Municipal Solid Waste Management its Generation and Characteristics of Waste:** Sources, Types, composition, quantity, sampling and characteristics of waste, factors affecting generation of solid wastes. Overview: problems and issues of solid waste management-Need for solid waste management-Functional elements such as waste generation, storage, collection, transfer and transport, processing, recovery and disposal in the management of solid waste.	**(06 Hrs)**
Unit-II	**Types of Solid Waste**: Waste products during manufacturing and packing, operation of pollution control facilities, generation and minimization at source, recycling, disposal, Bio medical waste-generation and management system, E-waste-generation and management system.	**(06 Hrs)**
Unit-III	**Disposal of Solid Waste:** Segregation, volume reduction at source, recovery and recycle; dumping of solid waste-sanitary, landfills-site selection-design and operation of sanitary landfill leachate, landfill gas management-landfill closure and environmental monitoring landfill remediation; Municipal solid waste in Indian conditions, legal aspects of solid waste disposal, plastic waste disposal and necessary equipment.	**(6 Hrs)**
Unit-IV	**Waste Collection, Storage and Transport:** Collection: Collection of solid waste–collection services–collection system, equipment–time and frequency of collection–labour requirement–factors	**(06 Hrs)**

	affecting collection–analysis of collection system–collection routes–preparation of master schedules. Transfer and Transport: Need for transfer operation–transfer stations–types –transport means and methods–location of transport stations–Manpower requirement–collection routes: Transfer stations–selection of location, types and design requirements, operation and maintenance.	
Unit-V	**Material & Energy Recovery:** Role of Circular Economy in context of Solid Waste Management, Material Recovery: Hand Picking, Screens, Float, Sink Separators, Magnetic Separators & Material Recovery Plants, Energy Recovery: Heat Value of Waste, Waste to Energy, Mass Burn System & RDF: Plant Design, Process Design, Efficiency, Residue Handling.	**(06 Hrs)**
Unit-VI	**Risk Assessment and Environmental Legislation:** Characterization and site assessment, Waste minimization and resource recovery, Laws for solid waste management.	**(06 Hrs)**
Reference Books:		
1	Handbook of Solid Waste Management, George Tchobanoglous and Frank Kreith, Second Edition, McGRAW-HILL	
2	Solid Waste Management, K. Sasikumar, Sanoop Gopi Krishna, PHI Learning, 2009	
3	Solid Waste: Engineering Principles and Management Issues, , George Tchobanoglous, 1st Edition, McGRAW-HILL	
4	Solid Waste Technology and Management Vol. 1 and 2, Thomas Christensen, Wiley Publishing,2010	
5	Solid Waste Management, Stefen Burnley, Wiley Publishing, 2014	

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

PROGRAM ELECTIVE-I: MODERN GEODESY AND GPS TECHNIQUES		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Basic Civil Engineering Subjects.
2	Surveying and Levelling.
3	Advance Surveying and Levelling.
Course Objective: On completion of the course -	
	it will provides a comprehensive understanding of modern geodesy, preparing students for practical applications in surveying, mapping, and geospatial sciences.
Course Outcomes: On completion of the course, the students will be able to -	
1	understand the fundamental concepts, scope, and evolution of geodesy, along with its significance in various scientific and engineering applications.
2	explain different geodetic reference systems, coordinate transformations, and their role in precise positioning and mapping.
3	describe the working principles of GPS and other GNSS systems, their components, and factors affecting positioning accuracy.
4	apply different GPS surveying techniques, such as static, kinematic, and RTK, and analyze GPS data for accurate geospatial measurements.
5	evaluate the practical applications of geodesy and GPS in fields such as mapping, navigation, land surveying, and disaster management.
6	explore emerging technologies in geodesy, including GNSS augmentation, AI integration, and future advancements in satellite-based positioning.

Course Content:

Unit-I	**Introduction to Modern Geodesy** Definition and Scope of Geodesy, Historical Development and Evolution, Types of Geodesy: Geometric, Physical, and Satellite Geodesy, Importance and Applications in Science and Engineering.	**(06 Hrs)**
Unit-II	**Geodetic Reference Systems and Coordinate Systems** Earth's Shape and Size: Geoid, Ellipsoid, and Reference Surfaces, Geodetic Datums: WGS84, NAD83, and ITRF, Coordinate Systems: Geocentric, Geodetic, and Local Topocentric, Transformations Between Different Geodetic Systems, Indian Datum or co-ordinate system (Everest).	**(06 Hrs)**
Unit-III	**Fundamentals of GPS and GNSS** Overview of Global Navigation Satellite Systems (GNSS), GPS: Segments (Space, Control, and User) and Working Principle, Other GNSS: GLONASS, Galileo, BeiDou, and Regional Systems, Sources of Errors in GPS Positioning.	**(06 Hrs)**
Unit-IV	**GPS Observation Techniques and Data Processing** Static and Kinematic GPS Surveying, Differential GPS (DGPS) and Real-Time Kinematic (RTK),Precise Point Positioning (PPP),GPS Data Processing and	**(06 Hrs)**

	Post-Processing.	
Unit-V	**Applications of Modern Geodesy and GPS** Mapping and Cartography, Navigation and Transportation, Land Surveying and Engineering, Disaster Management and Environmental Monitoring, Integration of GPS with Inertial Direction System and Lidar Scanner to form 'Mobile Mapper'.	**(06 Hrs)**
Unit-VI	**Advances in Satellite Geodesy and Future Trends** GNSS Augmentation Systems (SBAS, GBAS), Integration of GNSS with Remote Sensing and GIS, Use of Artificial Intelligence in Geodesy, Future Developments in Satellite Positioning and Geospatial Technologies.	**(06 Hrs)**

Reference Books:

1	James R. Smith "Introduction to Geodesy: The History and Concepts of Modern Geodesy" Publication Wiley-Interscience, *ISBN*: 978-0471166603
2	Erik Grafarend "Geodesy: The Challenge of the 3rd Millennium" *Publisher*: Springer , *ISBN*: 978-3-540-42962-3
3	Clement A. Ogaja "Introduction to GNSS Geodesy: Foundations of Precise Positioning Using Global Navigation Satellite Systems"
4	Elliott D. Kaplan and Christopher J. Hegarty "Understanding GPS/GNSS: Principles and Applications" Publication Artech House, *ISBN*: 978-1-63081-058-0
5	Willi Freeden and M. Zuhair Nashed "Handbook of Mathematical Geodesy" Springer, *ISBN*: 978-3-319-57181-2

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

PROGRAM ELECTIVE-I: GROUND IMPROVEMENT TECHNIQUES		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total :100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Geotechnical Engineering
2	Mechanics of fluids
Course Objective: On completion of the course -	
	the students will be able to understand the various ground improvement methods and their suitability for different soil conditions.
Course Outcomes: On completion of the course, the students will be able to -	
1	identify various types of problematic soils & Classify ground improvement techniques based on soil types.
2	apply appropriate densification methods for granular and cohesive soils to improve their engineering properties and performance
3	select soil dewatering techniques with respect to soil condition.
4	implement various grouting techniques based on specific field conditions
5	understand the methods and properties of reinforced soil
6	decide technique for soil stabilizations

Course Content:

Unit-I	**Introduction** Need and objectives of Ground Improvement in Geotechnical Engineering, Different types of problematic soils and concerns, Ground improvement techniques for different soil types, Classification of ground modification techniques, Factors affecting the selection of ground improvement techniques, Emerging trends in ground improvement techniques.	**(06 Hrs)**
Unit-II	**Densification Methods** Ground Improvement in Granular Soil: In place densification by Vibro-floatation, Compaction pile, Vibro-Compaction Piles, Dynamic Compaction & Blasting. Ground Improvement in Cohesive Soil: Compressibility, vertical and radial consolidation, preloading methods. Types of Drains, Design of vertical Drains, construction techniques. Stone Column.	**(06 Hrs)**
Unit-III	**Seepage Control & Dewatering** Definition, Objectives, Methods of Dewatering- Open Sumps and Ditches, well point Systems, Deep Well Systems, Vertical Sand Drains, Electro Osmosis, Cut off wall, Selection of Dewatering System.	**(06 Hrs)**
Unit-IV	**Grouting Technology** Grouting techniques types and suitability, Characteristics of grout material , Design consideration, Suspension and solution grouts, jet grouting, the jet	**(06 Hrs)**

	grouting process, application of jet grouting, Quality control and testing as per IS code, seepage control in soil for cut off walls – stabilization grouting for underpinning.	
Unit-V	**Soil Reinforcement** Define soil reinforcement, Types of soil reinforcements, Mechanism of soil reinforcement - Placement of reinforcement in soil – applications, Reinforcement of soil beneath the roads, foundation. Geosynthetics – Types – general applications – types of geotextiles and geo-grids – physical and strength properties of geotextiles and geogrids – behaviour of soils on reinforcing with geotextiles and geogrids.	**(06 Hrs)**
Unit-VI	**Soil Stabilization** Soil stabilization with admixtures like lime, fly-ash, cement etc, Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization, ground freezing, Micro piles, Soil nailing.	**(06 Hrs)**

Reference Books:	
1	M.R. Hausmann, "Engineering Principles of Ground Modification", McGraw-Hill International Edition.
2	Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing
3	P. Purushothama Raj, "Ground Improvement Techniques", Laxmi Publications (P) Ltd.
4	Bikash Chandra Chattopadhyay and Joyanta Maity, "Ground Improvement Techniques" Prentice-Hall of India (P) Ltd.
Reference Codes*:* The latest versions of the codes	
1	IS 13094 (1992): "Selection of ground improvement techniques for foundation in weak soils – Guidelines
2	IS 14343:1996 "Choice of Grouting Materials for Alluvial Grouting – Guidelines
Reference Links: List of Open Source Software/learning website:	
1	https://archive.nptel.ac.in/courses/105/108/105108075/

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

PROGRAM ELECTIVE-I: STRUCTURAL ASSESSMENT & RETROFITTING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Building Planning and Design
2	Concrete Technology
3	Structural Analysis
4	Design of Reinforced Concrete and Steel Structures
Course Objective: On completion of the course -	
	the student should be able to assess causes and extent of deterioration and select the right repair materials and methodology to increase the life of structures
Course Outcomes: On completion of the course, the students will be able to -	
1	identify and classify the basic terms of retrofitting.
2	diagnose the distress in the structure.
3	decide suitable assessment technique.
4	decide and suggest appropriate retrofitting material and technique.
5	evaluate the efficiency of the retrofitting material and technique.
6	prepare a detailed report on structural assessment

Course Content:

Unit-I	**Introduction:** Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements. National and International codal provisions.	**(06 Hrs.)**
Unit-II	**Assessment of Damage:** Preliminary assessment: Documentation of the general condition of the structure. Detailed surface inspection: Mapping of chloride induced corrosion and carbonation induced corrosion, Potential mapping and resistivity mapping, Cracks and crack mapping.	**(06 Hrs.)**
Unit-III	**Structural Assessment Techniques:** Structural health monitoring, Visual observations, Non-destructive (Rebound Hammer and Ultrasonic Pulse Velocity Test) and destructive testing, Selection of suitable technique of structural assessment.	**(06 Hrs.)**
Unit-IV	**Retrofitting Techniques:** Strengthening of reinforced concrete members (jacketing, fiber reinforcement), Steel bracing and shear walls, Base isolation systems, Energy dissipation devices (dampers), Masonry wall strengthening techniques, Selection of suitable retrofitting method.	**(06 Hrs.)**

Unit-V	**Design Considerations for Retrofitting:** Compatibility between existing and new structural elements, Detailing of connections for retrofitting elements, Material selection and properties for retrofitting, Load transfer mechanisms and stress distribution.	**(06 Hrs.)**
Unit-VI	**Practical Applications:** Report Writing, Case studies of retrofitting projects (e.g., seismic retrofitting of older buildings, strengthening of deteriorated structures), Cost-benefit analysis of retrofitting options, Regulatory considerations for retrofitting projects.	**(06 Hrs.)**

Reference Books:

1	P. H. Emmons and G M Sabnis, "Concrete Repair and Maintenance", Galgotia Publication
2	Repairs and Rehabilitation– Compilation from Indian Concrete Journals
3	George Somerville, "Management of Deteriorating Concrete Structures", , Taylor and Francis, Publication.
4	Susan Macdonald, "Concrete Building Pathology", Blackwell Publishing
5	C. L. Page, M M Page, "Durability of Cement and Cement Composites", Wood Head, Publishing
6	Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
7	Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.
8	R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL)

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

COURSE: PROGRAM ELECTIVE I - URBAN DEVELOPMENT		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of	
1	Building Planning and Design
2	Advanced Transportation Engineering
Course Objective: On completion of the course -	
	student will understand the concept and study the process of urban planning.
Course Outcomes: On completion of the course, the students will be able to -	
1	know various definitions of planning, various sources of planning knowledge and various forms of planning knowledge.
2	understand importance of Urban and Regional Planning at various levels
3	apply the knowledge of development plan and development control regulations also various guidelines and various land uses.
4	learn the concept and planning of smart cities.
5	discuss the basics of governance in planning and Global cities and its characters.
6	implement emerging trend in urban planning.

Course Content:

Unit-I	**Introduction:** Introduction to town and country planning; Scope & importance of town planning; principles of town planning; Goals and objectives of planning; Components of planning; Benefits of planning.	**(06 Hrs)**
Unit-II	**Basics of Planning:** Sustainability and rationality in planning; Components of sustainable urban and regional development; Town & Country Planning at National, Regional and Local levels; Physical planning process; Land-use planning, determinants of land use, Zoning and density control.	**(06 Hrs)**
Unit-III	**Land Use Planning & Zoning** Definition of development plan; Types of development plans: master plan, city development plan, structure plan, district plan, action area plan, subject plan, town planning scheme, regional plan, sub-regional plan; Planning Advisory Group report and the URDPFI Guidelines; Defining development and development control regulations,	**(06 Hrs)**
Unit-IV	**Smart City Planning** Concept of Smart City; Urban renewal, retrofitting and redevelopment program. Smart city planning for solid waste management, rejuvenation of streams and rivers, affordable housing to poor ,housing and slum redevelopment, energy efficient and green buildings, Water supply and its	**(06 Hrs)**

	management, Concept of intelligent transport network and green belts. E governance and citizen's participation.	
Unit-V	**Urban Governance and Policies:** Local government in India; District Planning Committees and Metropolitan Planning Committees; Use of remote sensing and GIS in planning; Introduction to Internationalization and globalization of planning.	**(06 Hrs)**
Unit-VI	**Emerging Trends and Case Studies:** Concepts of smart cities and digital urban planning, Integration of GIS and remote sensing in urban planning, Case studies of planned and unplanned cities, Future trends in sustainable urban development.	**(06 Hrs)**

Reference Books:

1	L.R. Kadiyali, " Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 2007
2	Annapurna Shaw ," Indian cities " Oxford India ,2012
3	B. Gallion, S. Eisner , "The Urban Pattern", Van Nostrand Reinhold Company,2003
4	ITPI, " City and Metropolitan Planning & Design" ITPI, New Delhi
5	Faludi, A. A Reader in Planning Theory - Pergamon Press, Oxford.
6	Faludi, A. Planning Theory - Pergamon Press, Oxford.
7	Keeble, L. Principles and Practice of Town - The Estate Gazette, London Town and Country Planning
8	McLoughlin, J.B. Urban and Regional Planning:- Faber and Faber, London. A System Approach
9	McLoughlin, J.B. Control and Urban Planning - Faber and Faber, London.
10	Hall, P. Urban and Regional Planning Fourth Routledge, London
11	Freidmann, J. Planning in the Public Domain - Princeton University Press, Princeton.
12	Fainstein, S.S. and Readings in Planning Theory - Mackwell. Campbell, S.
13	Smart City Guidelines, Ministry of Urban Development, Govt. of India. 2015

Reference Codes: The latest versions of the codes

1	Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines by Ministry of Urban Development, Government of India.

Reference Links*:* List of Open Source Software/learning website:

1	https://archive.nptel.ac.in/courses/124/107/124107158/

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

COURSE: PROGRAM ELECTIVE-I: HYDROLOGY		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 03 Hrs / Week	End Semester Examination : 60 Marks Internal Assessment : 40 Marks	Theory : 03
	Total : 100 Marks	Total : 03

Course Pre-requisites: The students should have knowledge of

1	Fundamentals of Civil Engineering

Course Objective: On completion of the course -

	the students will be able to analyze precipitation and estimate floods.

Course Outcomes: On completion of the course, the students will be able to -

1	examine aspects of the precipitation.
2	inspect abstraction from precipitation.
3	analyse stream flow measurement.
4	deduct runoff characteristics.
5	conclude characteristics of hydrographs and unit hydrographs.
6	estimate floods and adapt flood routing techniques.

Course Content:

Unit-I	**Introduction** Hydrologic Cycle, Water Budget Equation, Forms of Precipitation, Characteristics of Precipitation in India, Rain gauge Network, Preparation and Presentation of Rainfall Data, Mean Precipitation over an area, DAD(Depth-Area-Duration) Relationships, PMP, Climate change and changes in precipitation, rainy days and floods.	**(06 Hrs.)**
Unit-II	**Abstractions from precipitation** Evaporation Process, Evaporimeters, Empirical Evaporation Equations, Analytical Methods of Evaporation Estimations, Transpiration, Evapotranspiration, Equations, Interception, Infiltration, Infiltration Capacity, Measurement of Infiltration, Stage Discharge Relationships, Extrapolation of Rating Curves.	**(06 Hrs.)**
Unit-III	**Stream Flow Measurement** Measurement of Stage, Velocity, Area Velocity Method, Different Streamflow Measurement methods Dilution Technique, Electromagnetic Method, Ultrasonic Method, Indirect Method.	**(06 Hrs.)**
Unit-IV	**Runoff** Introduction, Hydrograph, Runoff Characteristics of Stream, Runoff Volume, Flow Duration Curve, Flow Mass Curve.	**(06 Hrs.)**
Unit -V	**Hydrograph** Factors Affecting Flood Hydrograph, Components of Hydrograph, Base Flow Separation, Effective Rainfall, Unit Hydrograph, Derivation of Unit Hydrograph, Unit Hydrographs of Different Durations, Use and Limitations of	**(06 Hrs.)**

	Unit Hydrographs, Synthetic Unit Hydrographs, instantaneous Unit Hydrograph.	
Unit -VI	**Floods and Flood Routing** Rational Methods, Empirical Formulae, Unit Hydrographs Method, Flood Frequency Studies, Design Flood, Basic Equations of Flood Routing, Hydrologic Storage Routing, Hydrologic Channel Routing, Flood Control, HEC-RAS Introduction.	**(06 Hrs.)**

Reference Books:	
1	H.M. Raghunath; 'Engineering Hydrology Principles, Analysis Design', New Age International Publications.
2	K Subramanya; 'Engineering Hydrology', Mc Graw Hill
3	Dr. P. Jaya Ram Reddy; 'A Textbook of Hydrology', University Science Press
Reference Codes: The latest versions of the codes	
1	IS 8389, "Installation and Use of Rain gauges, Recording - Code of Practice"
2	IS 4987, "Recommendations for establishing network of rain gauge stations"
3	IS 4849, "Meteorology — Rain Measures —Specification"
4	IS 4986, "Installation of Rain gauge (Non-Recording Type) and Measurement of Rain - Code of Practice"
Reference Links: List of Open-Source Software/learning website:	
1	https://onlinecourses.nptel.ac.in/noc23_ce44/preview
2	https://www.udemy.com/topic/hydrology/?srsltid=AfmBOorDIv_1fzBrtNXqfe9PG0FmZ_1BjkgcSq1mkuLVx-VhOnMMDpDK
3	https://ocw.mit.edu/courses/1-72-groundwater-hydrology-fall-2005/
4	https://www.classcentral.com/report/best-hydrology-courses/
5	https://www.udemy.com/course/basic-hydrology/?srsltid=AfmBOooFDs-UuHgdu2bFrmoKmzXAL-wnIpgjaeXGiZOhLR77xjhQVyQj

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

SKILL BASED COURSE–VI: COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Practical : 02 Hrs / Week	Termwork : 25 Marks Practical : 25 Marks	Practical : 01
	Total : 50 Marks	Total : 01

Course Pre-requisites: The students should have knowledge of	
1	Structural Analysis
2	Design of Steel Structures
3	Design of Reinforced Concrete Structures
Course Objective: On completion of the course -	
	the students will be able to analyze and design the building structures using software.
Course Outcomes: On completion of the course, the students will be able to -	
1	analyse the structure using FEM software.
2	design the steel structure using FEM software.
3	design the RC structure using FEM software.

Course Content:

Unit-I	**Structural Analysis:** Generation of Geometry; Assign Section properties, Support Conditions and Specifications; Apply Loads; Define Load Combinations; Analyse the structure; Read, plot and Interpret output of analysis.	**(08 Hrs)**
Unit-II	**Design of Steel Structure:** Assign parameters for steel design, Design the members, Optimise the design, interpret design output, Prepare Design Report.	**(08 Hrs)**
Unit-III	**Design of RC Structure:** Assign parameters for RC design, Design the members, Optimise the design, interpret design output, Prepare Design Report.	**(08 Hrs)**

Term work: The term work shall consist of-	
1	Modelling and analysis of 2D and 3D structure using FEM software.
2	Design of steel roof truss using FEM software.
3	Design of G+2 RC Building using FEM software.
Practical:	
	The practical examination will be based on above term work and course content.
Reference Books:	
1	"STAAD.Pro V8i Technical Reference Manual", Bentley Communities
2	Sham Tickoo, "Learning Bentley Staad.Pro V8i for Structural Analysis",BPB Publications
3	Sham Tickoo/TIET, "Exploring Bentley'S Staad.Pro Connect Edition", BPB Publications

4	T.S.Sarma, “Staad Pro V8i for Beginners: With Indian Examples”, Notion Press
5	T.S.Sarma, “Design of Industrial Steel Buildings Using Staad Pro: With Indian Examples”, Notion Press
Reference Links: List of Open Source Software/learning website:	
1	https://www.bentley.com/software/staad/
2	https://www.udemy.com/course/staad_prov8i/

Programme: B. Tech. (Common for All) Sem –VI (2023 course)

COURSE: PROFESSIONAL SKILLS		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Practical : 02 Hrs. / Week	Internal Assessment : 25 Marks	Practical : 01
	Total : 25 Marks	Total : 01

Course Pre-requisites: The students should have knowledge of

1	Basic mathematical concepts, reasoning skills, and comprehension abilities.
2	Fundamentals of communication processes and soft skills.
3	Basic understanding of leadership qualities, ethics, etiquettes, and values.

Course Objective: On completion of the course -

	well-rounded foundation in quantitative aptitude, logical and verbal reasoning, professional communication, employment skills, leadership development, and business ethics. By integrating these components, students will be better equipped to excel in recruitment processes and succeed in their professional careers.

Course Outcomes: On completion of the course, the students will be able to -

1	apply shortcut techniques to solve quantitative aptitude questions efficiently in recruitment and competitive exams.
2	utilize logical reasoning methods and mnemonics to enhance problem-solving skills in placement tests.
3	improve verbal communication skills, including vocabulary, sentence patterns, and reading comprehension, for effective professional interactions.
4	develop proficiency in job application writing, resume building, and interview skills to enhance employability..
5	understand and apply soft skills, leadership qualities, and professional ethics in the workplace.
6	demonstrate appropriate corporate etiquette, business ethics, and values in professional settings.

Course Content:

Unit-I	**Quantitative Aptitude:** Number System, Percentage, Profit and Loss, Simple & Compound Interest Ratio, Proportion, and Average, Mixture and Allegation, Time, Speed & Distance, Time & Work, Permutation & Combination, Probability, Pipes and Cisterns	**(04 Hrs.)**
Unit-II	**Logical Reasoning:** Coding-Decoding, Number Series, Blood Relation, Directions, Cubes & Dices, Data Interpretation, Data Sufficiency, Set Theory & Syllogisms, Matching, Selection & Arrangement, Clocks & Calendars, Visual Reasoning Input-Output & Flow Charts	**(04 Hrs.)**
Unit-III	**Verbal Reasoning:** Sentence Patterns, Sentence Correction, Spotting Errors, Vocabulary, Antonyms & Synonyms, Analogy, Phrasal Verbs, Idiomatic Expressions, Reading Comprehension, Cloze Test, Sentence Rearrangement and Theme Detection	**(04 Hrs.)**
Unit-IV	**Honing Employability And Presentation Skills:** Job Application Letters: Layout, Structure, Covering Letter, Resume & CV	**(04 Hrs.)**

	Building: Structure, Effective Writing Tips, Group Discussion: Skills, Strategies, and Evaluation, Interview Skills: Telephonic & Face-to-Face Interviews, Body Language, Grooming & Etiquette for GD & PI, Extempore Speaking Techniques, Presentation Skills: Structure, Layout, Flow, and PPT Creation	
Unit-V	**Soft Skills And Leadership Development:** Soft Skills: Definition, Importance, and Differences from Hard Skills, Life Skills & Personal Development, Team Building & Conflict Resolution, Problem-Solving, Time & Stress Management, Pareto Principle (80/20 Rule), Time Management Matrix, Leadership Skills: Importance, Types, Attributes of a Good Leader, Motivational Theories and Emotional, Intelligence in Professional Life	**(04 Hrs.)**
Unit-VI	**Business Ethics ,Etiquettes And Values:** Ethics & Values in the Business World, Respect for Individuality and Workplace Diversity, Key Features of Corporate Etiquette, Corporate Grooming & Dressing, Social & Office Etiquette, Importance of Professional Behavior in the Workplace, Corporate Social Responsibility (CSR): Need and Importance .	**(04 Hrs.)**

Internal Assessment:	
1	Solve 20 practice problems on Number System, Percentage, and Profit & Loss..
2	Create a comparative analysis of Simple Interest vs. Compound Interest with real-world examples.
3	Solve a set of logical reasoning problems covering Coding-Decoding, Blood Relations, and Directions.
4	Prepare a case study on how logical reasoning skills are used in competitive exams and corporate assessments
5	Identify and correct errors in 10 sentences focusing on sentence structure and grammatical mistakes.
6	Develop a vocabulary list with antonyms, synonyms, and phrasal verbs commonly used in professional settings.
7	Draft a job application letter along with a structured resume tailored for a technical position.
8	Participate in a mock group discussion and receive peer and instructor feedback.
9	Conduct a mock interview (telephonic & face-to-face) and submit an evaluation report
10	Conduct a self-assessment on personal soft skills and identify areas for improvement.
11	Develop a time management plan using the Pareto Principle (80/20 Rule) and Time Management Matrix.
12	Prepare a report on different leadership styles and their impact in the corporate world.
13	Write a report on corporate ethics and how companies implement ethical policies.
14	Conduct a role-play activity demonstrating appropriate corporate etiquette in business interactions.
15	Prepare a presentation on the significance of Corporate Social Responsibility (CSR).

Reference Books:	
1	Quantitative Aptitude by R. S. Agarwal published by S. Chand
2	The Book of Numbers by Shakuntala Devi

3	A Modern Approach To Logical Reasoning by R. S. Agarwal published by S. Chand
4	A New Approach to Reasoning Verbal & Non-Verbal by Indu Sijwali
5	Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition
6	Communication Skills by Sanjay Kumar, Pushp Lata, published by Oxford University press, second edition
7	Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
8	Developing Communication Skills by Krishna Mohan, Meera Banerji published by Macmillan India Pvt Ltd
9	Soft Skills by Meenkashi Raman, published by Cengage publishers
10	Soft Skills by Dr. K Alex published by Oxford University press
11	Soft skills for Managers by Dr. T. Kalyana Chakravarthi and Dr. T. Latha Chakravarthi published by biztantra

Programme: B. Tech. (Civil) Sem – VI (2023 Course)

VALUE ADDED COURSE-II: ETHICS AND ENGINEERS		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory : 02 Hrs / Week	Internal Assessment : 100 Marks	Theory : 02
	Total : 100 Marks	Total : 02

Course Pre-requisites: The students should have knowledge of

1	Universal Human Values

Course Objective: On completion of the course -

	to enable the students to create an awareness on engineering ethics and responsibilities and rights.

Course Outcomes: On completion of the course, the students will be able to -

1	respect human values.
2	follow engineering ethics.
3	design experimentations and assess safety responsibilities and rights.

Course Content:

Unit-I	**Human Values** Morals, Values and Ethics, Integrity, Work Ethics, Service Learning, Civil Virtue, Respect for others, Living Peacefully, Caring Sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, self Confidence, Character, Spirituality, Introduction to Yoga and Meditation. Engineering Council of India, Code of Ethics, Article 1,2 & 3.	**(08 Hrs.)**
Unit-II	**Engineering Ethics** Senses of Engineering Ethics, variety of Moral Issues, Types of Enquiries, Dilemma, Autonomy, Consensus and Controversy, Ethical theory of Right Action.	**(08 Hrs.)**
Unit-III	**Engineering as Social Experimentation & Safety Responsibilities and Rights** Introduction, Experimentation, Engineers as responsible experimenters, Code of Ethics and standards. Safety, Assessment of Safety & Risks, Respect for Authority, Confidentiality, Conflicts of Interests, Professional Rights, Employee Rights, Intellectual Property rights, Discrimination. Case studies related to safety of work in various discipline of engineering.	**(08 Hrs.)**

Internal Assessment: shall be based on **Three** Assignments and **Two** Case studies / presentations or Quizzes on topics below.

1	examining human values Morals and Ethics.
2	examining caring, sharing, honesty.
3	justifying valuing time, cooperation, and Commitment.
4	justifying Empathy, self-confidence, character.
5	determining senses of engineering ethics.
6	criticizing moral issues.
7	evaluating the type of enquiries.

8	interpreting dilemma and autonomy.
9	interpreting consensus and controversy.
10	Engineers as responsible experimenters.
11	code of ethics for different organizations.
12	assessment of safety and risks.
13	justifying respect for authority.
14	conflicts of interests.
15	professional rights.
16	Integrity of a professional
17	Work Ethics of a Professional
18	service learning in a society
19	Civil virtues
20	spirituality
21	Code of Ethics (Engineering Council of India) Article 1,2,3
22	ethical theory of right action
23	employee rights
24	discrimination
25	confidentiality
Reference Books:	
1	Govindarajan, M. Natarajan, S. Senthilkumar, V. S. "Engineering Ethics (Includes Human Values)" Prentice Hall India Learning Private Limited
2	Qin Zhu, Mike Martin, Roland Scherzinger, "Ethics in ENGINEERING" Mc Graw Hill
3	Caroline Whitbeck, "Ethics In Engineering Practice And Research", Cambridge University Press
Reference Links: List of Open Source Software/learning website:	
1	https://www.coursera.org/learn/ethics-in-engineering
2	https://onlinecourses.nptel.ac.in/noc22_mg54/preview
3	https://www.coursera.org/learn/ethics-technology-engineering
4	https://ocw.mit.edu/courses/esd-932-engineering-ethics-spring-2006/

B. Tech. – 2023 Course

Rules and Regulations

B. Tech. – 2023 Course

Rules and Regulations

(I) Theory

(A) Theory Examination

Theory examination consists of: (i) End semester examination (ESE), and (ii) Internal assessment (IA).

(i) ESE is of 60 marks for theory courses.

(ii) IA is of 40 marks. Following assessment tools shall be used for evaluation of IA.

a) Unit test
b) Project based learning
c) Case study
d) Presentation/ Seminar
e) Quiz
f) Open book test
g) Assignment
h) MCQ
i) Poster presentation
j) Modelling
k) Group discussion
l) Role play
m) Term paper/Research Paper

Note

1. Each semester shall include two Internal Assessments: Internal Assessment–I and Internal Assessment–II.
2. Internal Assessment–I will be based on Units I, II, and III, while Internal Assessment–II will cover Units IV, V, and VI.
3. It is mandatory to categorize the courses within each discipline into appropriate groups based on their nature. For each group, a set of 2 to 4 suitable assessment tools shall be identified and used for evaluation.
4. The Course Coordinator shall prepare a unit-wise plan for conducting the Internal Assessments using the selected tools and submit it to the Head of the Department before the commencement of

the academic term. A maximum of 2–3 tools may be selected for each course.

5. The Course Coordinator is also responsible for maintaining proper documentation of the Internal Assessments and shall submit the same to the Head of the Department at the end of the semester, if required.

6. All Internal Assessments must be designed, conducted, and evaluated in alignment with the appropriate levels of Bloom's Taxonomy.

(B) Standard of Passing

(i) There is a separate passing of 40% of 60 marks, i.e. 24 marks, for ESE for a given course.

(ii) There is a separate passing of 40% of 40 marks, i.e. 16, for IA for a given course.

(iii) A student who fails at ESE in a given course has to reappear only at ESE as a backlog student and clear the head of passing. Similarly, a student who fails at IA in a given course has to reappear only at IA as a backlog student and clear the head of passing

(II) Practical

(A) Practical Examination

Practical examination consists of: (i) Term work, and (ii) Practical/Oral examination for a given course based on term work.

(i) Term work (TW): TW marks are as mentioned in the curriculum structure.

(ii) Practical/Oral (PR/OR): PR/OR marks are as mentioned in the curriculum structure.

(B) Conduction of practical/oral examination

(i) A student will be permitted to appear for practical/oral examination only if he/she submits term work of a given course.

(ii) Practical/oral examination shall be conducted in the presence of internal and external examiners appointed by university.

(B) Standard of Passing

(i) A student shall pass both heads TW and PR/OR separately with minimum 40% of total marks of respective head.

(III) MOOC and Social Activity Course

(i) If a student completes one MOOC during a programme, he/ she will earn additional TWO credits, subjected to submission of the certificate of completion of the respective course. It is mandatory for a student to complete atleast two MOOC to obtain degree in a given discipline. Students shall register to MOOCs which are offered by any one the following agencies:

(a) SWAYAM : www.swayam.gov.in

(b) NPTEL : www.onlinecourse.nptel.ac.in

(c) Course Era : www.coursera.org

(d) edX online learning : www.edx.org

(e) MIT Open Course ware : www.ocw.mit.edu

(f) Udemy : www.udemy.com

(g) Spoken tutorial : www.spoken-tutorial.org

(ii) If a student completes social activity, he/she will earn additional TWO credits, subjected to submission of the certificate of completion of the respective course/ activity from the relevant authorities. It is mandatory for a student to complete atleast one social activities to obtain degree in a given discipline.

(iv) The additional credits for MOOC and Social Activity will be given only after verification of the authentic document by the Head of the Department and a separate mark-sheet will be submitted by the Head of the Department along with the course examiner.

(IV) Value Added Course (VAC) and Indian Knowledge System (IKS) Course

(i) The VAC and IKS courses are mandatory and must be passed by students during the designated semester to earn two credits.

(ii) These courses have an internal assessment worth 100 marks, which are distributed as follows: (a) three assignments, each worth 20 marks, and (b) two case studies, presentations, or quizzes, each worth 20 marks. Faculty members have the flexibility to choose between conducting two case studies, two presentations, two quizzes, or any combination thereof.

(V) Minor Programme

(i) A students shall receive a MINOR degree when he/she acquires additional 20 credits in a given specialization defined by the UG programmes offered at the institute.

(ii) The theory and practical/oral components for a given course are mentioned in curriculum structure. The theory and examination for a given course are mentioned in Section I and II.

(iii) The grade point, grade letter and equivalent marks system for MINOR programme is mentioned in Section V.

(iv) The MINOR DEGREE programme is OPTIONAL. The interested students may opt MINOR programme.

(v) A student shall complete the MINOR program prior to his/her graduation.

(VI) A. T. K. T

(i) A student who is granted term for B. Tech. Semester-I, III, V, VII will be allowed to keep term for his/her B. Tech. Semester-II, IV, VI, VIII examination, respectively even if he/she appears and fails or does not appear at B. Tech. Semester-I,III, V, VII examination respectively.

(ii) A student shall be allowed to keep term for the B. Tech. Semester-III course if he/she has a backlog of any number of Heads of passing at B. Tech. Semester-I & II taken together.

(iii) A student shall be allowed to keep term for the B. Tech. Semester-V of respective course if he/she has no backlog of B. Tech. Semester-I & II and he/she has a backlog of any number of Heads of passing at B. Tech. Semester-III & IV taken together.

(iv) A student shall be allowed to keep term for the B. Tech. Semester- VII of respective course if he/she has no backlog of B. Tech. Semester-I, II, III, IV and he/she has a backlog of any number of Heads of passing at B. Tech. Semester-V & VI taken together.

(VII) Grade Point, Grade Letter and Equivalent Marks

The student must obtain a minimum Grade Point of 5.0 (40% marks) in ESE and also in combined ESE + IA. A student who fails in ESE of a course has to reappear only to ESE as a backlog student and clear that head of passing.

Award of the Class for the Degree considering CGPA: A student who has completed the minimum credits specified for the programme shall be declared to be passed in the programme. The CGPA will be computed every year of all the courses of that year. The grade will be awarded according to the CGPA of every year.

Range of CGPA	Final Grade	Performance Descriptor	Equivalent range of Marks (%)
$9.50 \leq CGPA \leq 10.00$	O	Outstanding	$80 \leq Marks \leq 100$
$9.00 \leq CGPA \leq 9.49$	A+	Excellent	$70 \leq Marks < 80$
$8.00 \leq CGPA \leq 8.99$	A	Very Good	$60 \leq Marks < 70$
$7.00 \leq CGPA \leq 7.99$	B+	Good	$55 \leq Marks < 60$
$6.00 \leq CGPA \leq 6.99$	B	Average	$50 \leq Marks < 55$
$5.00 \leq CGPA \leq 5.99$	C	Satisfactory	$40 \leq Marks < 50$
CGPA below 5.00	F	Fail	Marks Below 40