REGULATION 2019

COURSE STRUCTURE

Syllabus

GIET UNIVERSITY

Gunupur-765022, Rayagada, Odisha

DEPARTMENT OF CIVIL ENGINEERING

School of Engineering and Technology

4 Year B.Tech Degree Programme

Regulation 2019

Vision of the Department:

To impart knowledge and excellence in Civil Engineering and Technology with global perspective and to make them ethically strong engineers to build the nation and to achieve standards of quality education with keeping in pace with rapidly changing in technology.

Mission of the Department:

- To impart latest technical knowledge of Civil Engineering with the state of art infrastructure and training methods.
- To provide global competency in the field of structural engineering with interface computer applications like Staad-Pro, AutoCAD etc.
- To make the students industry ready/suitable and to supplement the growth of the nation.

Programme Educational Objectives:

PEO-1:
To achieve a high level of technical expertise to shine in higher education / profession by obtaining knowledge in basic sciences, design and drawing and engineering principles

PEO-2:
To explore and apply the modern engineering tools for planning, design, execution and maintenance of works that is technically viable, economically and socially acceptable

PEO-3:
To develop good communication skills, team work in their responsibilities with excellence and to be ready to take up challenges in the current scenario

Programme Specific Outcomes:

1. ***PSO1:*** Analyze, Design, Construct, Maintain and Operate infrastructural projects
2. ***PSO 2:*** Assess the environmental impact of various projects and take required measures to curb environmental deterioration
3. ***PSO 3:*** Able to use latest software pertaining to various streams of Civil Engineering.

PROGRAM OUTCOMES

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage e in independent and life-long learning in the broadest context of technological change.

SECOND YEAR

THIRD SEMESTER		THEORY		
Sl.No	Course Code	Subject	Contact Hrs. L-T-P	Total Credits
1		Math-III	3-1-0	4
2	PC	Mechanics of Materials	3-0-0	3
3	PC	Construction Technology	3-0-0	3
4	EC	Environmental Science and Engineering	3-0-0	3
5	EC/HS	Economics for Engineers/ Organisational Behaviour	3-0-0	3
SESSIONAL				
6	PC	Concrete Lab	0-0-3	1.5
7	PC	Environmental Science Lab.	0-0-2	1
8	EC	Environmental Engineering Design	0-0-2	1
9	PC	Computer Application in Civil Engineering	0-0-3	1.5
NON-CREDIT				
		Essence of India Traditional Knowledge/ Environmental Sciences	0-0-0	0
TOTAL			15-1-10	21

FOURTH SEMESTER		THEORY		
SI. No	Course Code	Subject	Contact Hrs. L-T-P	Credit
1	PC	Structural analysis	3-0-0	3
2	PC	Surveying and Geomatics	3-0-0	3
3	PC	Geotechnical Engineering-I	3-0-0	3
4	PC	Fluid Mechanics	3-0-0	3
5	EC/HS	Organisational Behaviour/Economics for Engineers	3-0-0	3
SESSIONALS				
6	PC	Survey using auto level, Theodolite, total station	0-0-3	1.5
7	PC	Computer-aided Civil Engineering Drawing	0-0-3	1.5
8	PC	Geotechnical Engineering Lab	0-0-3	1.5
9	PC	Hydraulics Lab	0-0-3	1.5
NON-CREDIT				
		Environmental Sciences/ Essence of India Traditional Knowledge	0-0-0	0
		Summer Internship/ Training	0-0-0	0
TOTAL			15-0-12	21

THIRD YEAR

FIFTH SEMESTER		THEORY		
SI. No	Course Code	Subject	Contact Hrs. L-T-P	Credit
1	PC	Reinforced Concrete Design	3-1-0	4
2	PC	Water Resources Engineering	3-0-0	3
3	PC	Geotechnical Engineering-II	3-0-0	3
4	PE-I	Industrial Waste Water Management	3-0-0	3
		Advanced Surveying		
		River Engineering		
5	OE-I	Remote Sensing and GIS	3-0-0	3
		Watershed Management		
		Waste Management		
6		Professional Ethics, Professional Law &Human Values/ Financial Management, Costing, Accounting, Balance Sheet & Ratio Analysis	2-0-0	2
SESSIONAL				
1	PC	Structural Engineering Lab.	0-0-2	1
2	PC	Design of Concrete Structures based on Staad Pro	0-0-2	1
3	PC	Fluid Flow Lab.	0-0-2	1
TOTAL			17-1-6	21

SIXTH SEMESTER		THEORY		
SI. No	Course Code	Subject	Contact Hrs. L-T-P	Credit
1	PC	Transportation Engineering-I	3-0-0	3
2	PC	Steel Structure	3-1-0	4
3	PE-II	Advanced Concrete Technology	3-0-0	3
		Mechanics of Composite Materials		
		Rock mechanics and Tunnel Engineering		
4	PE-III	Hydraulic structures	3-0-0	3
		Water Resources Planning & Management		
		Urban Drainage and sewerage system		
5	OE-II	Project Management	3-0-0	3
		Town Planning & Architecture		
		Ground Improvement Technique		
6		Financial Management Costing, Accounting, Balance Sheet & Ratio Analysis/Professional Ethics, Professional Law &Human Values	2-0-0	2
SESSIONALS				
1	PC	Design of Hydraulic Structure	0-0-2	1
2	PC	Transportation Engineering Lab	0-0-2	1
3	PC	Design of Steel Structure	0-0-2	1
NON-CREDIT				
		Summer Industry Internship/ Training/ Project	0-0-0	0
TOTAL			17-1-6	21

FOURTH YEAR

SEVENTH SEMESTER		THEORY		
SL NO	COURSE CODE	SUBJECT	CONTACT HRS L-T-P	CR
1	PC	Advanced Structural Analysis	3-0-0	3
2	PC	Transportation Engineering-II	3-0-0	3
3	PE-IV	Estimation and Professional Practices	3-0-0	3
		Economic evaluation and analysis of transport project		
		Structural Design of Water and Sewerage System		
4	OE-III	Green building	3-0-0	3
		Water Power Engineering		
SESSIONALS				
1		Project - I	0-0-6	3
2		Seminar on internship	0-0-2	1
TOTAL			12-0-8	16

EIGHTH SEMESTER		THEORY		
SL NO	COURSE CODE	SUBJECT	CONTACT HRS L-T-P	CR
1	PE-V	Construction Management	3-0-0	3
		Pavement management system		
		Traffic Engineering & Management		
2	PE-VI	Ground Water Engineering	3-0-0	3
		Environmental Geo-technique		
		Pre-stressed Concrete		
3	OE-IV	Finite Element Method in Civil Engineering	3-0-0	3
		Environmental Management		
SESSIONALS				
1		Project II	0-0-12	6
2		Seminar on Project	0-0-2	1
TOTAL			9-0-14	16

The students should undergo Summer Internship or Project in India or Abroad for a minimum period of 8 weeks either in 4th& 6th Semesters together or in one semester at a stretch.

SCHEME OF INSTRUCTION SUMMARY

SL. NO.	COURSE WORK - SUBJECTS AREA	CREDITS / SEMESTER								TOTAL CREDITS
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences including Management Courses	3	3	2	2	-	-	3	-	**12**
2	Basic Science Courses	8	8	4	-	-	-	-	-	**20**
3	Engineering Science Courses including workshop, drawing, basics of electrical mechanical/computer etc.	10	10	4	4	-	-	-	-	**29**
4	Professional Core Courses	-	-	11	15	14	11	-	-	**51**
5	Professional Elective Courses relevant to chosen specialization / branch	-	-	-	-	3	6	6	3	**18**
6	Open subjects - Electives from other technical and/or emerging Subjects	-	-	-	-	3	3	3	6	**15**
7	Project work, Seminar and Internship in industry or elsewhere	-	-	-	-	-	-	7	8	**15**
8	Mandatory Courses [Environmental Sciences, Induction Training, Indian Constitution, Essence of Indian Traditional Knowledge]	0	0	0	0	-	-	-	-	**0**
	TOTAL	**21**	**21**	**21**	**21**	**20**	**20**	**19**	**17**	**160**

III Semester

Subject Code	Course Title	L	T	P	C	QP
	ENGINEERING MATHEMATICS-III	3	1	0	4	A

Course Outcomes

CO1	Apply the fundamental concepts of Ordinary differential equations and partial differential equations and basic numerical methods for their resolution.
CO2	Solving the problems choosing the best suitable method
CO3	Use computational tools to solve problems and applications of Ordinary Differential Equations and Partial Differential Equations.
CO4	Use an adequate scientific language to formulate the basic concepts of the course.
CO5	Formulate and solve differential equation problems in the field of Industrial Organization Engineering.

Unit:1 **[10-h]**

special functions :

Beta and Gamma functions, relation between Beta and Gamma functions, Error function, Series solution of differential equations (up to second order), Legendre equation, Legendre polynomials and their properties, Bessel's function.

Unit:2 **[8-h]**

Complex Analysis:

Analytic function, Cauchy-Riemann equations, Laplace equation, Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Unit:3 **[10-h]**

Taylor's series, Laurent's series, Singularities and zeros, Residue integration, evaluation of real integrals.

Unit:4 **[10-h]**

Approximation and round of errors, Roots of equation: fixed point iteration, the Newton-Raphson method. Interpolation: Lagrange Interpolation, Newton divided difference interpolation, Newton's forward and backward interpolation. Numerical Differentiation, Numerical integration: The trapezoidal rule, The Simpson's rules, Ordinary differential equation: Euler's method, modified Euler's method.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
2. Numerical method for Engineers by M. K. Jain and Iyenger.

Ref. Books

1. Higher Engineering Mathematics by B S Grewal :Khanna Publishers, New Delhi.
2. Numerical Analysis by Dutta and Jena

Subject code	course title	L	T	P	C	QP
PC	**MECHANICS OF MATERIALS**	3	0	0	3	A

Course Outcomes	
CO-1	Calculate and understand the concepts of stress and strain relationships for homogenous, isotropic materials.
CO-2	Calculate, describe, and estimate external loadings, including axial load, shear force, bending, and torsion, and the resulting deformations and internal stresses associated with these external loadings
CO-3	Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member

UNIT-1 **[10-h]**

Simple stress and strain

Load, Stress, Principle of St. Venant, Strain, Direct stress, Hooke's Law, Modulus of Elasticity, Stress and strain diagram of mild steel, Elasticity and plasticity - Types of stresses and strains, Working stress, Factor of safety, Lateral strain, Bars of varying section, Composite bars, Temperature stresses. Strain Energy, Resilience.

Shear stress-

Shear stress, Complementary shear stress, shear strain, modulus of rigidity, Derivation of formula for Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections, Shear centre, Relationship between elastic constants

Theories of failure-

Maximum normal stress theory, maximum normal strain theory, maximum shearing strain theory, maximum strain energy theory, maximum distortion energy theory, maximum octahedral shearing stress theory

UNIT-2 **[11-h]**

Flexural Stresses-

Theory of simple bending, Assumptions, Derivation of bending equation: $M/I = f/y = E/R$, Neutral axis, Determination of bending stresses, Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections.

Torsion-

Torsion in solid and hollow circular shafts, Twisting moment, strength of solid and hollow circular shafts, strength of shafts in combined bending and twisting, closed coil helical spring

UNIT-3 **[12-h]**

Compound Stresses and Strains-

Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Maximum shear stresses, Mohr's stress circle, Two-dimensional stress-strain system Principal strains and principal axis of strain, calculation of principal stresses from principal strains, Analysis of strains, Mohr's strain circle, Strain rosettes, determination of principal strains from strain measurements

UNIT-4 **[14-h]**

Thin cylinders and spheres-

Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures

Buckling of Columns-

Short and long columns with axial load, eccentric loading of columns, core of the section, Euler's theory of initially straight columns with various end conditions, Combined bending and direct stress

Teaching mehod:-Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text books:-1. Elements of Strength of Materials by S.P.Timoshenko and D.H.Young, Affiliated East West Press

2. Strength of Materials by G. H. Ryder, Macmillan Press

Ref.books:- 1. Mechanics of Materials by Beer and Johnston, McGraw Hill

2. Mechanics of Materials by R.C.Hibbeler, Pearson Education

Subject code	course title	L	T	P	C	QP
PC	**CONSTRUCTION TECHNOLOGY**	3	0	0	3	**A**

Course Outcomes	
CO1	Ability to understand functions of various components of building structures.
CO2	Ability to understand the various stages of construction.
CO3	To gain knowledge on various mechanized materials to help in construction industries
CO4	Ability to know regarding the Building maintenance and safety

Unit:1 **[10-h]**

Introduction of various Civil Engineering structures, Functions of various components of building and other structures

Fundamentals of Construction Technology: Introduction, Construction activities, construction process, construction workers, construction estimating, construction estimate, productivity and mechanized construction, Quality and safety.

Preparatory Work and Implementation: Site layout, deployment of construction equipment, prefabrication in construction, false work and temporary work.

Unit:2 **[10-h]**

Earthwork: Introduction, Classification of soil, project site development, setting out, mechanized excavation, Piling: classification of piles, pile driving methods, load test and quality control

Concrete and Concreting: Introduction, Important properties of concrete, Use of admixtures, formwork, shotcrete, lightweight and heavyweight concrete, ready-mix concrete, high performance concrete, self-compacting concrete, extreme weather concreting, prestressed concrete, curing of concrete, non-destructive testing of hardened concrete

Roof and roofing: Introduction, cast-in-situ reinforced concrete roofs, precast reinforced concrete roofs, roofs covered with sheets, water proofing over roofs

Finishing Work: Introduction, plastering, pointing, facing, glazing, flooring, painting

Unit:3 **[11-h]**

Mechanized Construction: Introduction, general consideration, plants for earthwork tractor, Bulldozer, ripper, scraper, face shovel, backhoe, dragline, clamshell etc., roller, plants for transportation, movement and handling- derrick, crane, hoist, concrete mixers and pumps scaffolding

Building items: Plastering & pointing- its purpose, various types

Construction procedures, advantages and disadvantages, Damp proof course (DPC), Anti-termite measures and treatment

Unit:4 **[12-h]**

Building Maintenance and Safety Measures: Purpose, need, importance, methods, Causes and types of defects in buildings, Preparation of report on maintenance work, Remedial measures and execution procedure of any one type of building maintenance work, Importance of various Laws / Norms / Regulations / Acts for safety, Precautions and precautionary Measures, Post-accident procedures.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Construction Technology, Subir Sarkar and Subhajit Saraswati, Oxford University Press
2. Construction Planning and Management, U.K. Srivastava, Galgotia Publications Pvt Ltd
3. Construction Engineering and Man agent, S. Seetharaman, Umesh Publications
4. Building Construction", Sushil Kumar, Standard Publishers Distributors, New Delhi

Subject Code	Course title	L	T	P	C	QP
EC	**ENVIRONMENTAL SCIENCE & ENGINEERING**	3	0	0	3	A

Course Outcomes

CO1	To identify sources of water, general requirement for water supply and characterize water
CO2	To understand the principals of water treatment and design treatment units.
CO3	To understand the principals of waste water treatment and design treatment units.
CO4	To identify and quantify noise and air pollutants

Unit:1 **[10-h]**

Quantity of water: Sources of water, Per capita demand, design period, population forecast, fluctuation in demand.

General requirement for water supply: Types of intakes, Pumping and Transportation of water.

Quality of water: Physical, chemical and biological characteristics of water and their significance, necessity of treatment, Drinking water standards

Unit:2 **[8-h]**

Basic unit operations and unit processes for surface water treatment: Screening, Plain Sedimentation, Sedimentation aided with Coagulation, Filtration, Disinfection, Softening

Miscellaneous treatments (principles only): Removal of colours, tastes and odours, removal of iron and manganese, fluoridation and defloridation, Ion exchange, electro-dialysis, RO

Unit:3 **[10-h]**

Quantity and characteristics of wastewater, effluent discharge standards.

Domestic wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation. Secondary treatment: Basis of microbiology Growth and food utilization, Suspended-culture systems, Attached-culture systems, Secondary clarification, Disinfections of effluents. Sludge treatment and disposal: Sludge characteristics, thickening, disposal

Unit:4 **[10-h]**

Air pollution*:* Units of measurement, Sources and Classification of air pollutants.

Influence of meteorological phenomena on air quality: Lapse rate and dispersion, Engineered systems for air pollution control: Gravitational settling chamber, cyclone, ESP, Bag filter and scrubbers, National Ambient air quality standards.

Noise Pollution*:* Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Environmental Engineering (Volume I & II) by S. K. Garg-Khanna Publishers
2. Environmental Engineering (Volume I & II) by B. C. Punmia-Khanna Publishers
3. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous

Subject Code	Course title	L	T	P	C	QP
EC	**ECONOMICS FOR ENGINEERS**	3	0	0	3	A

Course Outcomes

CO1	Explain the basic economic concepts on micro economics in terms of the law of demand and supply.
CO2	Outline the various theories of production in short run as well as in long run
CO3	Evaluate the tool of break-even analysis to make production decisions of the firm and make use of depreciation calculations
CO4	Formulate and apply interest factors to real life engineering problems and evaluate engineering alternatives with the help of economic analytical techniques
CO5	Understand the financial structure of Indian economy, measuring national income, and measures of controlling inflation.

CO-PO & PSO Mapping

POS/COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1						1					2	2			
CO2						1					3	1			
CO3						1					3	2			
CO4						2					3	1			
CO5						2					3	2			
Avg.						1.4					2.8	1.6			

SYLLABUS

UNIT:1 **[12-h]**

Engineering Economics –

Meaning, Nature, Scope, Basic problems of an economy, Micro economics and Macro Economics.

Demand and Supply Analysis -

Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand &its measurement (Simple numerical problems to be solved)

Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, and Determination of market equilibrium (Simple numerical problems to be solved).

Theory of Production -Production function, Laws of returns: Law of variable proportion, Law of returns to scale

UNIT:2 **[12-h]**

Cost and revenue concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into Fixed and variable costs. Basic understanding of different market structures, Price and output Determination under perfect competition (Simple numerical problems to be solved),

Break Even Analysis -

Linear approach (Simple numerical problems to be solved). Depreciation-Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method

UNIT:3 **[12-h]**

Time value of money -

Interest Analysis - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-

Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects. Sensitivity Analysis, Replacement Analysis- Determination of economic life of an asset, Replacement of existing asset with a new asset.

UNIT:4 **[09-h]**

Overview of Indian financial system. Commercial bank, Functions of commercial bank, Credit creation, Central bank, Functions of Central Bank. Inflation-
Meaning of inflation, types, causes, measures to control inflation.
National Income - Definition, Concepts of national income, Method of measuring national income

Teaching Methods: Chalk& Board/ PPT

Text Books

1, Vengedasalam, Deviga. Madhavan, Karunagaran, Principles of Economics, Oxford University Press.
2. R. Paneer Seelvan, " Engineering Economics", PHI
3. Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd
4.Paul, R.R., Money, Banking and International Trade, Kalyni Publishers.

Reference Book:

1. Riggs,J.L., Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
2. Park, Chan.S, "Fundamental of Engineering Economics", Pearson.
3. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
4. Thuesen, G.J.,Fabrycky,. Engineering Economy, PHI.

Subject Code	Course Title	L	T	P	C	QP
EC/HS	**ORGANISATIONAL BEHAVIOUR**	3	0	0	3	A

Course Outcomes	
CO1	Define, explain and illustrate a range of organizational behaviour theories.
CO2	Analyse the behaviour of individuals and groups in organizations in terms of organizational behaviour theories, models and concepts.
CO3	To explain group dynamics and demonstrate skills required for working in groups (team building)
CO4	Communicate effectively in oral and written forms about organizational behaviour theories and their application using appropriate concepts, logic and rhetorical conventions.
CO5	To explain organizational culture and describe its dimensions and to examine various organizational designs

Unit – I **[14-h]**

Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behaviouristic and social cognitive), Limitations of OB.

Attitude: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behaviour and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes.

Personality and values: Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications.

Perception: Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect).

Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation.

Unit-II **[12-h]**

Foundations of Group Behaviour: The Meaning of Group & Group behaviour & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development.

Managing Teams: Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building.

Leadership: Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership

Unit – III **[14-h]**

Organizational Culture : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.

Unit – IV **[08-h]**

Organizational Change: Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change.

Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change &Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.

Subject Code	Course title	L	T	P	C	QP
PC	**CONCRETE LAB**	0	0	3	1.5	A

Course Outcomes	
CO1	Ability to determine quality of Cement
CO2	Ability to characterise sand and coarse aggregate
CO3	Ability to know fresh properties of concrete
CO4	Ability to understand hardened properties of concrete
CO5	Ability to determine quality of bricks.

1. Fineness of Cement by Sieve analysis and by air permeability method.
2. Standard consistency & Setting times of cement
3. Specific gravity & Soundness of cement
4. Compressive strength of cement
5. Shape size test, Water absorption & Compressive strength of Brick
6. Grain size distribution, Specific gravity and water absorption of fine and coarse aggregates.
7. Unit mass and Voids of concrete aggregates and Bulking of fine aggregates
8. Slump test & Compaction factor test of wet concrete.
9. Stress-strain curve, modulus of elasticity, and poison's ratio of concrete.
10. Flexural strength and split tensile strength tests of concrete.

Subject Code	Course title	L	T	P	C	QP
PC	**ENGINEERING SCIENCE LAB**	0	0	3	1.5	A

Course Outcomes	
CO1	Ability to determine quality of waste water sample
CO2	Ability to characterise hardness and alkalinity of waste water sample
CO3	Ability to know properties of BOD and COD
CO4	Ability to understand Microbiological analysis of water/wastewater sample

1. Determination of Taste, Odour and Colour of water/wastewater sample
2. Determination of pH, Temperature, E. Conductivity and D.O. of water/wastewater sample
3. Determination of TS, TDS and SS of water/wastewater sample
4. Determination of hardness & alkalinity of water sample
5. Determination of Turbidity and $SO4^{-2}$ of water sample
6. Determination of Ca^{+2}, Na^{+} and K^{+} of water sample
7. Determination of residual chlorine and Cl^{-} of water sample
8. Determination of BOD of water/wastewater sample
9. Determination of COD of water/wastewater sample
10. Microbiological analysis of water/wastewater sample
    - **a.** Determination of physical characteristics of water.
    - **b.** Determination of chemical characteristics of water.
    - **c.** Determination of biological characteristics of water.
    - **d.** Determination of physical characteristics of wastewater.
    - **e.** Determination of chemical and biological characteristics of wastewater.

Subject Code	**Course title**	**L**	**T**	**P**	**C**	QP
PC	**COMPUTER APPLICATION IN CIVIL ENGINEERING**	0	0	3	1.5	A
Course Outcomes						
CO1	Ability to design 2D and 3D plans by AutoCAD					
CO2	Ability to design multi-storey buildings by creating arrays in AutoCAD					
CO3	Ability to know basic commands to design in less time					
CO4	Ability to plan the basic things required to design the various types of building structures					

1. **AUTOCAD**: Introduction to AUTOCAD, basic commands for 2D drafting, Dimensioning, Layers and Blocks, Basic drawing using AUTOCAD, Simple building drawing using AUTOCAD, Single and multi-storey building (plan, section and elevation and 3D view).

IV SEMESTER

Subject Code	Course title	L	T	P	C	QP
PC	**STRUCTURAL ANALYSIS**	3	0	0	3	**A**
Course Outcomes						
CO1	Ability to understand various internal forces like axial force, shear force and bending moment in structures					
CO2	Ability to determine internal forces in statically determinate structures like beams, arches, cables and stiffening girders					
CO3	Ability to determine deformation of statically determinate beams and in pin-jointed plane trusses using appropriate methods					
CO4	Ability to determine various internal forces due to rolling or moving loads and their maximum influence on determinate beams, arches, cables with stiffening girders					

Unit:1 **[10-h]**

Introduction to statically determinate/ indeterminate structure with reference to 2D and 3D structures, free body diagram of structure, introduction to kinematically determinate/indeterminate structures with reference to 2D and 3D structures

Unit:2 **[10-h]**

Bending moment and Shear Force Diagrams for statically determinate beams:
Bending moment (BM) and shear force (SF), BM and SF diagrams for cantilevers, simply supported with or without overhangs under different types of loadings. Relationship between B.M, S.F and loading.
B.M. shear and normal thrust of three hinged arches
Suspension Cables: Three hinged stiffening girders

Unit:3 **[08-h]**

Introduction to method of superposition, strain energy, virtual work, reciprocal theorem and Castigliano's theorem
Deflection of statically determinate beams: Integration method, Moment area method, Conjugate beam method, strain energy method, unit load method.
Deflection of pin-jointed trusses using strain energy method, unit load method

Unit:**4** **[10-h]**

ILD for determinate beams for reactions at supports, S.F. at given section, B.M. at a given section, Maximum shear and maximum bending moment at given section, Problems relating to beams, three hinged arch, suspension cables, stiffening girders.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Structural Analysis – Norris & Wilber
2. Indeterminate Structures – J.S. Kenney

Ref. Books

Structural Analysis – C.S.Reddy, TMH Publication

Subject Code	Course Title	L	T	P	C	QP
PC	**SURVEYING AND GEOMATICS**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Carry out different types of surveying in the field of civil engineering
CO2	Carry out linear measurements and different types of levelling
CO3	Apply total station and EDM in distance measurement and traversing
CO4	Apply advanced surveying techniques in different fields of civil engineering

Unit:1 **[10-h]**

Geo-informatics – (Definition & Importance, Concept of Geoid and reference spheroids, Coordinate Systems), Basic Surveying – (Definition & Objective, Plane and Geodetic Surveys, General Classification of Surveys and its Principles), Surveying Errors – (Sources, Types of errors and their treatment, Accuracy), **Maps-** (Types, importance, scales, conventional symbols, and generalization; topographic maps, map projection systems), Idea about measuring Instruments..

Unit:2 **[10-h]**

Linear Measurements – (Direct and indirect methods, Error and Correction of linear measurement, Optical methods

Levelling and trigonometric levelling; Levelling: Types of levelling and their uses, permanent adjustment, curvature and refraction effects

Unit:3 **[09-h]**

Angular Measurement – (Principle, Instrument - Compass and Theodolite, Meridian, Bearing & Bearing System, Local attraction, Theodolite traversing, Concept of Latitude and Departure)

Triangulation and Trilateration -

Electronic methods- EDMs, total stations

Unit:4 **[09-h]**

Curve Survey – (Curve – types & elements, setting out work)

Photogrammetric - Principle, Scale, flying height, Number of Photographs, Deduction of distance & height scale

Remote sensing - basics, platform and sensors, visual image interpretation.

Basics of Geographical information system (GIS) and Geographical positioning system (GPS)

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Surveying – Punmia, Vol. – I, Laxmi Publication.
2. Surveying – Vol –II – By B.C. Punmia, A K Jain and A K Jain, Laxmi Publishers

Higher Surveying – Vol –II By B.C. Punmia, A K Jain, Laxmi Publishers

Subject Code	Course title	L	T	P	C	QP
PC	**GEOTECHNICAL ENGINEERING-I**	3	0	0	3	A

Pre-Requisites (If any) –

Course Outcomes	
CO1	Carry out soil classification and can solve three phase soil system.
CO2	Solve any practical problems related to soil stress estimation, permeability , seepage including flow net diagram
CO3	Solve practical problems related to consolidation settlement and time rate of settlement and able to solve problem related to compaction in the field.
CO4	Ability to solve practical problems related to shear stre s ngth of oil

Unit:1 **[10-h]**

Introduction: Origin of soils, formation of soils, clay mineralogy and soil structure, basic terminology and their relations, index properties of soils. Soil classification: Particle size distribution, use of particle size distribution curve, Particle size classification, textural classification, HRB classification, Unified classification system, Indian standard soil classification system, Field identification of soils. capillary tension, capillary siphoning. Stress conditions in soil: Total stress, pore pressure and effective stress

Unit:2 **[12-h]**

Permeability: Darcy's law, permeability, factors affecting permeability, determination of permeability (laboratory and field methods), and permeability of stratified soil deposits. Estimation of yield from wells.

Seepage analysis: Seepage pressure, quick condition, Laplace equation for two –dimensional flow, flow net, properties and methods of construction of flow net, application of flow net, seepage through anisotropic soil and non-homogenous soil

Unit:3 **[10-h]**

Soil compaction: Compaction mechanism, factors affecting compaction, effect of compaction on soil properties, density moisture content relationship in compaction test, standard and modified proctor compaction tests, field compaction methods, relative compaction, compaction control.

Soil consolidation: Introduction, spring analogy, one dimensional consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation

Unit:4 **[10-h]**

Shear strength of soils: Mohr's stress circle, theory of failure for soils, determination of shear strength (direct shear test, tri-axial compression test, unconfined compression test, van shear test), shear characteristics of cohesion less soils and cohesive soils.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.

Ref. Books

1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
2. Soil Mechanics, T.W. Lambe & Whiteman, Wiley Eastern Ltd, Nw Delhi.

Subject Code	Course title	L	T	P	C	QP
PC	**FLUID MECHANICS & HYDRAULIC MACHINES**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to know about fluid properties and pressure measurement.
CO2	Ability to analyse hydrostatic forces on surfaces and study of buoyancy and flotation.
CO3	Ability to understand basics of kinematics and dynamics of fluid flow.
CO4	Ability to study of flow through pipes and computation of coefficients of orifices and mouthpieces.

Unit:1 **[10-h]**

Properties of fluids :Introduction, definition of fluid, development of fluid mechanics, unit of measurement, mass density, specific weight, specific volume, specific gravity, viscosity, vapour pressure, compressibility and elasticity, surface tension and capillarity

Fluid pressure and its measurement: Fluid pressure at a point, variation of pressure in a fluid, Pascal's law, atmospheric absolute, gauge and vacuum pressure, measurement of pressure

Unit:2 **[10-h]**

Hydrostatic forces on surfaces: Total pressure and centre of pressure, total pressure on plane surface(horizontal, vertical, inclined, curved),centre of pressure on vertical and inclined plane surface, pressure diagram, practical application of total pressure and centre of pressure(dam, gate and water tank)

Buoyancy and Flotation: Buoyancy, buoyant force and centre of buoyancy, metacentre and metacentric height, stability of submerged and floating body, determination of metacentric height (experimental and theoretical)

Unit:3 **[10-h]**

Kinematics of fluid flow: Introduction, velocity of fluid particles, types of fluid flow, description of flow pattern, basic principle of fluid flow, continuity equation, acceleration of a fluid particle, rotational and irrotational motion, circulation and vorticity, velocity potential, stream function, stream lines, equipotential lines, flow net , its uses and limitations

Dynamics of fluid flow: Introduction, forces acting on fluid in motion, Euler's equation of motion, Bernoulli's equation of motion, Kinetic energy correction factor, Bernoulli's equation for a compressible fluid, pressure velocity relationship and its application(venture meter, orifice meter, nozzle meter),pitot tube.

Unit:4 **[10-h]**

Flow through pipes: Introduction, types of flow, laws of fluid friction(laminar flow and turbulent flow),Formulae for head loss due to friction in pipes(Darcy-Weisbachequation,Chezy'sformula,Manning's formula, Hazen-William's formula),other energy losses in pipe, Hydraulic grade line and energy grade line, flow through long pipes, flow through pipes (series, parallel, equivalent, by-pass, branched, syphonic),

Orifices and mouthpieces: Introduction, classification of orifices, flow through an orifice, hydraulic coefficients (velocity, contraction and discharge), flow through large orifices, classification of mouthpieces.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books:-

Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N. Modi and S.M. Seth, Standard Book House.

Ref. Books

1. Fluid mechanics by A.K. Jain, Khanna Publishers.
2. Engineering Fluid Mechanics by K.L. Kumar, S. Chand & Co.
3. Fluid Mechanics by V.L. Streeter, MGH

Subject Code	Course title	L	T	P	C	QP
PC	**SURVEY USING AUTO LEVEL, THEODOLITE, TOTAL STATION**	0	0	3	1.5	A

Course Outcomes	
CO1	Ability to carry out the survey by using Autolevel
CO2	Ability to carry out the survey by using theodolite
CO3	Ability to survey vertical and horizontal angle by using ETS and plot the area
CO4	Ability to know basic use of GPS

a. Study of theodolite in detail - practice for measurement of horizontal and vertical angles.
b. Study of various parts of Auto Level
c. Carry out Fly Levelling using Auto Level
d. Profile Levelling using Auto Level
e. Observations of Vertical and Horizontal angles using Total Station
f. Determine of area using total station.
g. Distance, gradient, diff, height between two inaccessible points using total station.
h. Study of Global Positioning System (GPS) and its Accessories
i. Observations using GPS

Subject Code	Course title	L	T	P	C	QP
PC	**COMPUTER-AIDED CIVIL ENGINEERING**	0	0	3	1.5	A

Course Outcomes	
CO1	Ability to design 2D and 3D plans by AutoCAD
CO2	Ability to design multi-storey buildings by creating arrays in AutoCAD
CO3	Ability to know basic commands to design in less time
CO4	Ability to plan the basic things required to design the various types of building structures

1. Introduction to computer aided drafting
2. Software for CAD – Introduction to different software‘s
3. Practice exercises on CAD software
4. Drawing of plans of buildings using software
a) Single storeyed buildings b) multi storeyed buildings
5. Developing sections and elevations f or
a) Single storeyed buildings b) multi storeyed buildings
6. Detailing of building components like Doors, Windows, Roof Trusses etc. using CAD software
7. Exercises on development of working of building

Subject Code	Course title	L	T	P	C	QP
PC	**GEOTECHNICAL ENGINEERING LAB**	0	0	3	1.5	A

Course Outcomes

CO1	Classify soil by physical observation of the soils.
CO2	Classify soil based on estimated index and engineering characteristics of soils
CO3	Ability to find soil properties in field
CO4	Ability to estimation density water content relationship
CO5	Ability to find consolidation and shear parameter to design foundation

1. Determination of specific gravity of soil grains
2. Determination of grain size distribution of soil: (a) sieve analysis; (b) Hydrometer/pipette test
3. Determination of Atterberg limits of soil: (a) liquid limit, (b) plastic limit, (c) shrinkage limit
4. Measurement of unit weight of soil in the field: (a) Core cutter method, (b) Sand replacement method
5. Determination of Density-water content relationship of soil: Proctor compaction tests.
6. Determination of relative density of granular soil
7. Determination of shear strength of soil: (a) Direct shear test (b) Tri-axial shear test, (c) Unconfined compression test (d) Vane shear test
8. Determination of consolidation characteristics of soil using fixed ring Oedometer
9. Determination of California Bearing Ratio (CBR) of soaked and un-soaked soil samples
10. Determination of coefficient of permeability of soil: (a) Constant head Permeameter (b) Falling head Permeameter

Subject Code	Course title	L	T	P	C	QP
PC	**FLUID MECHANICS LAB**	0	0	3	1.5	A

Course Outcomes

CO1	Ability to distinguish pipe flow patterns
CO2	Ability to determine coefficient of discharge(C_d) for different meters in pipes

1. Study of discharge measuring, pressure measuring and velocity measuring equipment
2. Verification of Bernoulli's theorem.
3. Determination of Darcy-Weisbach friction factor for pipe flow.'
4. Study of Moody's chart for pipe flow.
5. Study of flow patterns using Reynolds apparatus.
6. Study of free vortex and forced vortex.
7. Determination of coefficient of discharge for venturi-meter.
8. Determination of coefficient of discharge for orifice meter.
9. Determination of coefficient of discharge for nozzle meter.
10. Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for circular orifice.
11. Determination of metacentric height for a ship model.

V SEMESTER

Subject code	course title	L	T	P	C	QP
PC	**REINFORCED CONCRETE DESIGN**	3	1	0	4	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Understand the design philosophy and flexural behaviour of reinforced concrete beams.
CO2	Analysis and design of reinforced concrete beams for shear torsion, bond and deflection.
CO3	Analysis and design of reinforced concrete slabs and stair cases.
CO4	Analysis and design of reinforced concrete short Columns for foundation

Unit:1 **[09-h]**

Properties of concrete and reinforcing steel, philosophy, concepts and various methods of reinforced concrete design.

Introduction to Limit state method: analysis and design of beams (Single reinforced, double reinforced and flanged sections) for flexure.

Unit:2 **[09-h]**

Analysis and design of beams for shear torsion, bond and deflection

Unit:3 **[09-h]**

Design of one way and two way slabs, Design of staircases, Design of compression members: Short column, Column with eccentric loading (uni-axial and bi-axial bending) and Long columns using of design charts.

Unit:4 **[09-h]**

Design of foundation: Wall footing, Isolated and combined footing for columns.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Design of Reinforced Concrete Structue by N. Subramanian, Oxford University Press
2. Limit State Design by A.K.Jain, Neemchand& Bros
3. Reinforced Concrete Design by S U Pillai& D. Menon, McGraw Hill

Code Book- IS 456,SP-16 and SP-32.

Ref books:

Limit state design of reinforced concrete by P.C. Verghese, PHI

Reinforced concrete by B. C. Punmia, A. K. Jain and A. K. Jain

Subject code	course title	L	T	P	C	QP
PC	**WATER RESOURCE ENGINEERING**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to understand the hydrological cycle and its different types of ways to identify
CO2	Ability to understand the discharge movement and estimation of discharge
CO3	Ability to understand the plotting of hydrograph by using certain characteristics and ability to control the flow
CO4	Ability to understand the open channel flow equations

Unit:1 **[10-h]**

Precipitation, its Measurement and Analysis: Hydrologic cycle, catchment area and watershed, Rainfall and its characteristics, Rain gauges, Non-Recording and Recording type, Average rainfall over a catchment, Evapo-transpiration, Pan evaporation, Pan coefficient, Infiltration, Windex and -Index.

Unit:2 **[08-h]**

Discharge Measurement: Stream gauging, Flow rating curve, Use of current meters for velocity measurement, Dye-dilution method of discharge measurement, Estimation of discharge.

Unit:3 **[10-h]**

Hydrograph: Characteristics of a Run off hydrograph, Unit hydrograph, S-hydrograph, Instantaneous Unit hydrograph, Synthetic Unit hydrograph, Duration Curve, Mass flow hydrograph.

Flood Control: Flood flows, Frequency studies, Statistical analysis for flood prediction, Method of flood control, Flood routing, Reservoir routing and Channel routing, River training works.

Unit:4 **[10-h]**

Open Channel Flow: Definition, Uniform flow, Chezy'sKutter's equation, Most economical section, specific energy, critical, subcritical, supercritical flow, Non-uniform flow, Gradual varied flow, Hydraulic jump,

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Engg. Hydrology by K. Subramanian, McGraw-Hill
2. Hydrology and Water Resources Engineering by K. C. Patra, Narosa Publishing House, New Delhi

Subject code	course title	L	T	P	C	QP
PC	**GEOTECHNICAL ENGINEERING-II**	3	0	0	3	**A**

Course Outcomes	
CO1	To analysis stress distribution due various loading condition
CO2	To understand the different types of foundations required to transfer load to the soil
CO3	Ability to understand subsoil exploration and various earth pressures and different types of retaining structures
CO4	Carry out the stability analysis of slopes and embankments.

Unit:1 **[12-h]**

Stress distribution in soil: Boussinesq equations, Stress isobar and pressure bulb concept, pressure distribution on horizontal and vertical planes, stresses due to point load, line load, and strip load, uniformly loaded circular and rectangular areas. Use of Newmark's chart. Westergaard's solution. Approximate methods (point load method, two-to-one load distribution method). Contact pressure distribution due to loaded areas. Concept of active zone.

Unit:2 **[08-h]**

Shallow foundation: Introduction, bearing capacity, methods and determination of bearing capacity, settlement of foundations.

Deep foundation: Classification of pile, pile driving methods, pile capacity (static and dynamic analysis) pile-group analysis, load test on piles.

Unit:3 **[12-h]**

Subsoil exploration: Methods, direct (test pits, trenches), semi-direct (borings), indirect (sounding, penetration tests, and geophysical methods). Planning of exploration programme, spacing and depth of boring, soil sampling, types of samples, standard penetration test, static and dynamic cone penetration test, in-situ vane shear test. Seismic refraction method, electrical resistivity methods.

Lateral earth pressure and retaining structures: Earth pressure at rest, active and passive earth pressure. Earth pressure theories, Rankine's theory, Coloumb's wedge theory, Rebhann's and Culmann's graphical methods, stability conditions for retaining walls.

Unit:4 **[10-h]**

Stability of earth slopes: Stability of infinite slopes, stability analysis of finite slopes, Swedish method of slices, fiction circle method, Bishop's method. Use of Taylor stability number. Fellnious method for locating centre of critical slip circle.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1.Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.

Ref. Books

1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
2. Soil Mechanics, T.W. Lambe& Whiteman, Wiley Eastern Ltd, Nw Delhi.
3. Foundation Engineering, P.C. Verghese, Prentice Hall of India

Subject Code	Course title	L	T	P	C	QP
PE	**INDUSTRIAL WASTE WATER MANAGEMENT**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	To be able to understand the characteristics of industrial waste.
CO2	To understand the theory required for the industrial wastewater treatment unit processes.
CO3	To study the waste water treatment flow sheets for different industrial wastes.
CO4	To understand the principals of primary industrial waste water treatment and design treatment units.
CO5	To understand the principals of secondary and tertiary industrial waste water treatment and design treatment units.

Unit:1 **[12-h]**

Types of industries and industrial pollution, Characteristics of industrial wastes, Population equivalent, effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health.
Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

Unit:2 **[12-h]**

Aerobic and anaerobic biological treatment, Sequencing batch reactors, high rate reactors, chemical oxidation, ozonation, Photo catalysis, Wet Air Oxidation, Evaporation, Ion Exchange, Membrane Technologies, Nutrient removal
Waste management Approach, Waste Audit, Volume and strength reduction, Material and process modifications, Recycle, reuse and by-product recovery, Zero effluent discharge

Unit:3 **[11-h]**

Sources, Characteristics, waste water treatment flow sheets for selected industries such as Textile, Tannery, Pharmaceutical, Dairy, Sugar, Pulp and Paper, Distillery, Steel plants, Oil refineries, fertilizer

Unit:4 **[10-h]**

Waste minimization, Equalization, Neutralization, Oil separation, Flotation, Precipitation, Heavy metal Removal, adsorption

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Environmental Engineering (Volume II) by S. K. Garg-Khanna Publishers

Ref. Books

1. Eckenfelder(2000)- “Industrial Water pollution Control”- McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA
2. Mahajan (1984) –” Pollution control in Process industries”. TMH, New Delhi.
3. Rao and Dutta (2007)- “Waste Water Treatment”- Oxford & IBH Pulishing Co. Pvt. Ltd., New Delhi
4.Azad N. S., “Industrial Wastewater Management Hand Book” McGraw Hill book Co., Newyork.

Subject Code	Course title	L	T	P	C	QP
PE	**ADVANCED SURVEYING**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to EDM for finding horizontal and vertical angle
CO2	Ability to calculate area of a traverse by using different methods such as triangulation, aerial photogrammetry.
CO3	Ability to use RS & GIS to prepare a map of a certain area
CO4	Ability to understand on the concept of Geodesy

Unit:1 **[10-h]**

Electromagnetic distance measurement (EDM) – Principle of EDM Carrier waves – Types of EDM instruments – Distomat – Total Station – Principle – procedure & surveying using Total Station – precise levelling - micro-optic theodolite.

Unit:2 **[10-h]**

Photogrammetry – Terrestrial and Aerial Photogrammetry – Horizontal position of a point from photographic measurement – elevation of a point – Determination of focal length of camera -Geometry and scale of vertical photographs – Ground co-ordinates from vertical photographs -Relief displacement – Plan metric mapping from vertical photos – Stereoscopy– Photointerpretation.

Unit:3 **[10-h]**

Remote sensing – concepts – Idealized remote sensing system – characteristics – Types of remote sensing system – Remote sensing from space – Data interpretation – application of remote sensing – LIDAR – RADAR - SONAR.

Unit:4 **[10-h]**

Geodesy – Figure of earth – Classification – Earth surface - Geodetic reference surfaces Coordinate systems – Geodetic datum and elements – Map – Scale of map – projection UTM– Map projection of India – Space Geodesy – VLBI – SLR - LLR.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Duggal, S.K. Surveying Vol. II, Tata McGraw Hill.
2. Punmia, B.C. Surveying Vol.III, Standard Publishers.

Reference Books:

1. Arora, K. R. Surveying Vol. III, Standard Book House.
2. Satheesh Gopi. Advanced Surveying, Pearson Education.
3. Satheesh Gopi. The Global Positioning System and Surveying using GPS, Tat Mc Graw.

Subject Code	Course Title	L	T	P	C	QP
PE	**RIVER ENGINEERING**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to understand the fluvial system
CO2	Ability to understand the problem of flow in a river
CO3	Ability to understand sediment transport
CO4	Ability to understand river morphology

Unit:1 **[12-h]**

Introduction: The fluvial system, variables for alluvial rivers, rivers ,their behaviour, control and training: Importance of rivers and necessity of controlling them, types of rivers and their characteristics, Indian rivers and their classification, behaviour of rivers

Unit:2 **[12-h]**

Introduction, The problem of flow in a river, River hydraulics: The one-dimensional equations of hydraulics, Structures, controls, and boundary conditions, Measurement and analysis: Hydrometry and the hydraulics behind it, the analysis and use of stage and discharge measurements, Computational hydraulics: steady flow, unsteady flow

Unit:3 **[12-h]**

Sediment transport: General, Initiation of motion, Bed forms and alluvial roughness, Transport formulae, unsteady aspects

Unit:4 **[12-h]**

River morphology: Introduction, Regime concept, channel-forming discharge, hydraulic geometry, meander plan form, Longitudinal stream profile, river classifications, thresholds in river morphology, bends, Channel characteristics, Bifurcations and confluences, geomorphic analysis of river channel responses

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

Chang, H.H. (1988), Fluvial Processes in River Engineering, John Wiley and Sons

Ref. Books

Fenton, J. (2011), River Engineering, Institute of Hydraulics and Water Resources Engineering, Vienna University of technology

Subject Code	Course Title	L	T	P	C	QP
OE	**REMOTE SENSING AND GIS**	3	0	0	3	A

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to know about application of remote sensing in Civil Engineering
CO2	Ability to know about application of GIS in Civil Engineering
CO3	Ability to understand basics of GIS
CO4	Ability to understand data development and management in GIS

Unit:1 **[08-h]**

Remote Sensing: Introduction, Overview, Applications of remote sensing in Civil Engineering

Unit:2 **[08-h]**

Introduction: Overview, GIS, Applications of GIS in Civil Engineering, GIS Analysis Functions and **Operations:** Overview of GIS Analysis Functions, Spatial Data Capture and Maintenance, Geometrics and Measurements

Unit:3 **[08h]**

Introduction to geographic Information Systems: Overview, GIS Basics, Maps and map Data characteristics, User Interfaces and Interaction Modes, GIS System planning and Implementation, GIS

Unit:4 **[10-h]**

GIS Data and Databases: Overview, GIS Data Development and Maintenance, GIS Data Models, Digital Data Sources for Civil Engineering, Geodatabases

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books:

Lynn E. Johnson (2009) “Geographic Information Systems in Water Resources Engineering” Taylor and Francis Group, CRC Press, Boca Raton, FL.

Reference Books:

Lynn E. Johnson (2014) “GIS and Remote Sensing Applications in Modern Water Resources Engineering” Springer, New York.

Subject Code	Course Title	L	T	P	C	QP
OE	**WATERSHED MANAGEMENT**	3	0	0	3	A

Course Outcomes

Pre-Requisites (If any) –

CO1	Ability to know about concept of watershed
CO2	Ability to understand about rainfall runoff modelling
CO3	Ability to understand about soil erosion modelling
CO4	Ability to analyze storm water, flood and drought management modelling

Unit:1 **[10-h]**

Introduction and basic concepts: Concept of watershed, Introduction to watershed management, different stack holders and their relative importance, Watershed management policies and decision making.

Unit:2 **[10-h]**

Watershed Modelling: Standard modelling approaches and classification, system concept for watershed modelling, overall description of different hydrologic processes, modelling of rainfall runoff process, subsurface flows and groundwater flow.

Unit:3 **[08-h]**

Soil Erosion Modelling: Soil Erosion, Estimation of soil erosion.

Management of Water Quality: Water quality and pollution, types and sources of pollution, water quality modelling, environmental guidelines for water quality.

Unit:4 **[08-h]**

Storm Water and Flood Management: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies of flood damage.

Drought Management: Drought assessment and classification, drought analysis techniques, drought mitigation planning.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

E.M. Tideman (1996) "Watershed management: Guidelines for Indian Conditions", Omega Scientific, New

Ref. Books

1. Ghanshyam Das (2004) "Hydrology and Soil Conservation Engineering", Prentice-Hall of India Pvt. Limited.
2. Rajvir Singh (2003) "Watershed Planning & Management", Yash Publishing House.
3. DeBarry, Paul A. (2004) "Watersheds - Processes, Assessment and Management", John Wiley & Sons Hoboken, USA.
4. Vijay P. Singh, Donald K. Frevert (2005) "Watershed Models", CRC Press.

Subject Code	Course Title	L	T	P	C	QP
OE	**WASTE MANAGEMENT**	3	0	0	3	A

Course Outcomes

Pre-Requisites (If any) –

CO1	To be able to understand components of solid waste management system.
CO2	To evaluate recovery, treatment and disposal alternatives for solid waste.
CO3	To understand the generation and management of hazardous waste.
CO4	To study biomedical and radioactive waste management and to introduce concept of e-waste and soil remediation.

Unit:1 **[10-h]**

Solid waste – sources and engineering classification, characterization, generation and quantification.
Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Unit:2 **[10-h]**

Solid Waste treatment methods - various methods of refuse processing, recovery, recycle and reuse, **composting**– aerobic and anaerobic, incineration, pyrolysis and energy recovery.
Disposal methods – Impacts of open dumping, site se lection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

Unit:3 **[08-h]**

Hazardous Waste Management- Introduction, Sources, Classification, Physico-chemical, Chemical and Biological Treatment of hazardous waste, regulations.
Thermal treatment - Incineration and pyrolysis.

Unit:4 **[08-h]**

Biomedical Waste management- Definition, sources, classification, collection, segregation Treatment and disposal.
Radioactive waste management - Definition, Sources, Low level and high level radioactive wastes and their management, Radiation standard by ICRP and AERB

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

Environmental Engineering (Volume II) by S. K. Garg-Khanna Publishers

Ref. Books

1. Environmental Engineering (Volume II) by B. C. Punmia-Khanna Publishers
2. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.

Subject Code	Course title	L	T	P	C	QP
PC	**STRUCTURAL ENGINEERING LAB**	0	0	2	1	A

Course Outcomes	
CO1	Ability to determine tensile strength and % of elongation of steel
CO2	Ability to perform bend and rebend test
CO3	Ability to prepare mix design concrete by various proportions
CO4	Ability to determine ILD for indeterminate structure

1. Determination of tensile strength and percentage of elongation of steel, Stress- strain curve of steel, Modulus of Elasticity.
2. Bend and rebend test of steel reinforcement.
3. Mix design of Concrete as per IS:10262-1982
4. Testing of RCC beam
5. Non-destructive tests of concrete
6. ILD for indeterminate structure
7. Finding reactions and forces for three hinged arch.

Subject Code	Course title	L	T	P	C	QP
PC	**DESIGN OF CONCRETE STRUCTURES ON STAAD-PRO**	0	0	2	1	A

Course Outcomes	
CO1	Ability to design and detailing of various types of beams
CO2	Ability to design and detailing of different types of slabs
CO3	Ability to design and detailing of various loaded columns
CO4	Ability to design and detailing of framed building with different structural elements by using softwares

1. Design and detailing of singly and doubly reinforced sections
2. Design and detailing of flanged sections
3. Design and detailing of slabs: one way, two way, cantilever and continuous
4. Design and detailing of staircases
5. Design and detailing of axial, uniaxial and biaxial loaded columns
6. Design and detailing of isolated footings
7. Design and detailing of framed building with different structural elements: manual and using commercial software

Subject Code	**Course title**	**L**	**T**	**P**	**C**	QP
PC	**FLUID FLOW LAB**	0	0	2	1	A

Course Outcomes	
CO1	Ability to design and detailing of various types of beams
CO2	Ability to design and detailing of different types of slabs
CO3	Ability to design and detailing of various loaded columns
CO4	Ability to design and detailing of framed building with different structural elements by using softwares

1. Study of discharge measuring, pressure measuring, velocity measuring and depth measuring equipments
2. Determination of Manning's constant, Chezy's constant and Darcy-Weisbach friction factor for open channel
3. Determination of coefficient of discharge for broad crested weir and sharp crested weir.
4. Determination of coefficient of discharge for v-notch and rectangular notch.
5. Determination of specific energy for open channel flow.
6. Study of specific energy applications using hump and width constriction.
7. Establishment of different types of hydraulic jumps & determination of characteristics of the jumps
8. Study of various types of surges and their characteristics.
9. Study of boundary layer growth for open channel flow using velocity profile
10. Determination of percentage of slip and efficiency of the double acting reciprocating pump and draw its characteristic curve
11. Determination of overall efficiency of Francis turbine with constant DC loading
12. Determination of overall efficiency of Pelton turbine under constant speed with alternating load

VI SEMESTER

Subject Code	Course Title	L	T	P	C	QP
PC	**TRANSPORTATION ENGINEERING-I**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	To understand current trends in transportation.
CO2	To learn geometric design of highway system.
CO3	To understand traffic characteristics and their control.
CO4	To understand highway material characteristics and to learn the design of pavements

Unit:1 **[10-h]**

Transportation Infrastructure: Modes of transportation – their importance & limitation. Highway Development & Planning in India: Classification of roads and road patterns, Historical Development of road construction, Highway alignment: Requirements, factors controlling alignment & Engineering surveys for Highway alignment.

Unit:2 **[12-h]**

Geometric Design of Highways: Cross-sectional elements, Sight Distances, Horizontal alignments: Horizontal Curves, Super elevation design, Attainment of Super elevation, Radius of horizontal Curve, Extra Widening, Transition Curve and Setback Distance. Vertical alignments- Gradients, Types and Length of Vertical Curves, Grade Compensation on Horizontal Curve

Unit:3 **[10-h]**

Traffic Engineering: Traffic Studies- Volume studies, Speed Studies, O-D Studies, Capacity Studies and Level of service, Peak hour factor, parking study, accident study and analysis, , Statistical analysis of traffic data, Microscopic and macroscopic parameters of traffic flow, fundamental relationships, Operations and Traffic Control devices, Signal design by Webster's method. Types of intersections and channelization.

Unit:4 **[10-h]**

Highway Pavements materials: Aggregate - desirable properties & quality control tests of Aggregates, Bitumen-Types, Source, desirable properties & quality control tests of bitumen. CBR Test of Soil, Design of bituminous paving mixes by Marshall Method.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

Highway Engineering-By Khanna & Justo (Nemchand& Bros., Roorkee (U.A)

Ref. Books

1. Principles & Practice of Highway Engineering – By Dr. L.R. Kadiyalli (Khanna publisher)
2. Relevant IRC codes/ Specifications.

Subject Code	Course title	L	T	P	C	QP
PC	**STEEL STRUCTURE**	3	1	0	4	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	To understand the limit state design method of design of steel structures
CO2	Identify the different failure modes of steel tension and compression members and beams, and compute their design strengths.
CO3	Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria.
CO4	To design the various elements of plate girders and roof trusses

Unit:1 **[10-h]**

Introduction, advantages/disadvantages of steel, structural steel, rolled steel section, various types of loads, design philosophy.

Limit state design method; limit states of strength and serviceability, probabilistic basis for design Riveted, bolted and pinned connections, Welded connections-assumptions, types, design of fillet welds, intermittent fillet weld, plug and slot weld, failure of welded joints, welded joints vs bolted and riveted joints

Unit:2 **[10-h]**

Tension members, types, net cross-sectional area, types of failure, slenderness ratio, design of tension members, gusset plate.

Compression members, effective length, slenderness ratio, types of cross-section, classification of cross section, design of axially loaded compression members, lacing, battening, design of column bases, and foundation bolts.

Unit:3 **[10-h]**

Design of beams, types of c/s, lateral stability of beams, lateral torsional buckling, bending and shear strength, web buckling and web crippling, deflection, design procedure.

Unit:4 **[10-h]**

Plate girders- various elements and design of components Eccentric and moment connections, roof trusses

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Design of Steel Structures- Limit State Method by N. Subramanian, Oxford University Press
2. Limit State Design of Steel structures by S.K. Duggal, Mc-Graw Hill

Subject Code	Course title	L	T	P	C	QP
PE	**ADVANCED CONCRETE TECHNOLOGY**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy
CO2	Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete
CO3	Evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure
CO4	Design a concrete mix which fulfils the required properties for fresh and hardened concrete

Unit:1 **[10-h]**

Concrete Making Materials : Cement – Bogus Compounds – Hydration Process – Types of Cement – **Aggregates** – Gradation Charts – Combined Aggregate – Alkali Silica Reaction – Admixtures – Chemical and Mineral Admixtures.

Fresh and Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding.

Unit:2 **[10-h]**

Hardened Concrete: Abrams Law, Gel space ratios, Maturity concept – Stress strain behaviour – Creep and Shrinkage – Durability Tests on Concrete – Non Destructive Testing of Concrete.

High Strength Concrete – Microstructure – Manufacturing and Properties – Design of HSC

Unit:3 **[10-h]**

Erintroy Shaklok method – Ultra High Strength Concrete. High Performance Concrete –Requirements and Properties of High Performance Concrete – Design Considerations

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications.

Unit:4 **[10-h]**

Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit – Mix Design Method – BIS Method – DOE Method – Light Weight Concrete, Self Compacting Concrete.

Form work – materials – structural requests – form work systems – connections specifications design of form work – shores – removal for forms – shores – reshoring failure of form work.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Concrete Technology - Gambhir, M.L., , McGraw Hill

2. Properties of Concrete by A.M.Neville

Ref. Books

1. Concrete Technology by M.S.Shetty. - S.Chand& Co.

2. *Concrete Technology by Santakumar A.R, Oxford University Press*

Subject Code	Course title	L	T	P	C	QP
PE	**MECHANICS OF COMPOSITE MATERIALS**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	To reproduce the basic knowledge of mathematics, science and engineering in the areas of Composite materials, classifications and applications.
CO2	To explain the mechanical behaviour of layered composites compared to isotropic materials.
CO3	To apply constitutive equations of composite materials and understand mechanical behaviour at micro and macro levels.
CO4	An ability to analyse a laminated plate in bending, including finding laminate properties from lamina properties

Unit:1 **[10-h]**

Classification and characteristics of Composite Materials, advantages and limitations, Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotropy, Orthotropy and Anisotropy.

Unit:2 **[10-h]**

Characteristics and configurations of lamina, laminate, micromechanics and macro mechanics, Constituent materials and properties.

Unit:3 **[10-h]**

Elastic behaviour of unidirectional lamina, Strength of unidirectional lamina, Macro mechanical failure theories: Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu).

Unit:4 **[10-h]**

Elastic Behaviour of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. RM Jones, ‘Mechanics of Composite Materials’, McGraw-Hill Book Company
2. IM Daniel and O Ishai, ‘Engineering mechanics of composite materials,’ Oxford university press

Ref. Books

1. PK Mallick, ‘Fiber-reinforced composites’, Marcel Dekker inc
2. D Hull and TW Clyne, ‘An introduction to composite materials’, Cambridge University Press
3. JN Reddy, ‘Mechanics of laminated composite plates and shells: theory and analysis’, CRC Press.

Subject Code	Course title	L	T	P	C	QP
PE	**ROCK MECHANICS AND TUNNEL ENGINEERING**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Students should be conversant with scope and problems of Rock Mechanics
CO2	Students should be exposed with Rock exploration , laboratory testing etc.
CO3	Student should be conversant with mechanical, thermal and electrical properties of rock mass.
CO4	Student should be conversant with Deformation characteristics of rocks.

Unit:1 **[10-h]**

Introduction, objective, scope and problems of Rock Mechanics, Classification by origin, Lithological, Engineering.

Unit:2 **[10-h]**

Rock exploration, rock coring, geophysical methods. Laboratory testing of rocks, all types of compressive strength, tensile and flexural strength tests,. Strength and failure of rocks, Griffith's theory, Coulombs theory, rheological methods. In-situ tests on rock mass.

Unit:3 **[10-h]**

Mechanical, thermal and electrical properties of rock mass. Correlation between laboratory and field properties. Analysis of stresses

Unit:4 **[10-h]**

Thick wall cylinder, formulae, Kreish equation, Green span method. Openings in rock mass and stresses around Pressure tunnels, development of plastic zone. Rock support needed to avoid plastic deformation. Linked and unlinked tunnels. Underground execution and subsidence. Rock mechanics applications.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. STAGG K. G. and ZIENKIEWICZ O. C.: Rock Mechanics in Engineering Practice
2. FARMER: Rock Mechanics.

Ref. Books

1. FAIRHURST C.: Design Methods in Rock Mechanics
2. HOSKINS E. R. Jr : Applications of Rock Mechanics
3. HARDY H. R. Jr. New Horizons in Rock Mechanics
4. O'BERT and LEONARD: Rock Mechanics and Design of Structure

Subject Code	Course title	L	T	P	C	QP
PE	**HYDRAULIC STRUCTURES**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to understand irrigation techniques and water requirement of crops
CO2	Ability to develop of irrigation channels using sediment transport theory.
CO3	Ability to analyze stability criteria of gravity dam and its design.
CO4	Ability to analyze seepage phenomenon of earthen dam and design of spillway.

Unit:1 **[14-h]**

Irrigation techniques: Definition and necessity, advantages and disadvantages, types, techniques, quality of irrigation water

Water requirement of crops: Crop period and base period, duty and delta, crop seasons, optimum utilization if irrigation water and irrigation efficiencies ,consumptive use, effective rainfall, consumptive irrigation requirement, net irrigation requirement, factors affecting consumptive use, estimation of consumptive use, soil moisture irrigation relation, depth and frequency estimation of irrigation

Canal irrigation system: Types of canals, alignment of canals, distribution system, determination of required channel capacity and estimation of channel losses

Unit:2 **[14-h]**

Sediment transport and design of irrigation channels: Sediment load, bed formation, mechanics of sediment transport, design of non-scouring stable channel, stability of channel slopes

Design for irrigation channels: Design procedure (Kenedy's method and Lacey's method), cross-section, balancing depth, fixing of L-section

Lining of irrigation channels: advantages, justification, channel cross-section, permissible velocity, and types of lining (rigid lining and earth type lining)

Unit:3 **[13-h]**

Canal falls: Definition and location, types

Cross drainage works: Types, selection

Diversion head works: Layout, components, weir and barrage

Design of weirs and barrages: Bligh's creep theory, Lane's creep theory, Khosla's theory and concept of flow net, design of weirs and barrages on the basis of Khosla's theory

Unit:4 **[12-h]**

Regulators and Modules: Canal regulators, canal escapes, canal outlets or modules

Various types of dams: Selection of types of dams and their classification, factors governing selection of a particular dam, selection of dam site

Gravity dams: Definition, typical cross-section, forces acting, modes of failure, criteria for structural stability, stability analysis, design considerations and fixing the section of a dam, design of a dam

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

Irrigation Engineering and Hydraulic Structures by S.K. Garg, Standard Publishers

Ref. Books

1. Engineering Hydrology by K. Subramanya, Tata McGraw Hill
2. Irrigation Engineering by N.N. Basak, PHI

Subject Code	Course title	L	T	P	C	QP
PE	**WATER RESOURCES PLANNING AND MANAGEMENT**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to understand water resources planning and management issues
CO2	Ability to model water resources systems
CO3	Ability to understand river basin planning models
CO4	Ability to know about flood management

Unit:1 **[12-h]**

Water Resources Planning and Management: An overview: Introduction, Planning and Management Issues, Cause of Planning and Management, Scanty Water, Excessive Water, Polluted Water, Degradation of Aquatic and Riparian Ecosystems, Other Planning and Management Issues, System Components, Planning Scales and Sustainability, Spatial Scales for Planning and Management, Temporal Scales for Planning and Management, Sustainability Planning and Management, Approaches, Top-Down Planning and Management, Bottom-Up Planning and Management.

Unit:2 **[12-h]**

Water Resource Systems Modelling: Its Role in Planning and Management: Introduction, Modelling of Water Resources Systems, an Example Modelling Approach, Characteristics of Problems to be Modelled, Challenges in Water Resources Systems Modelling, Challenges of Planners and Managers, Challenges of Modelling, Challenges of Applying Models in Practice, Developments in Modelling, Modelling Technology, Decision Support Systems, Shared-Vision Modelling, Open Modelling Systems, Example of a DSS for River Flood Management

Unit:3 **[12-h]**

River Basin Planning Models: Introduction, Scales of River Basin Processes, Model Time Periods, Modelling Approaches for River Basin Management, Modelling the Natural Resources System and Related Infrastructure, Watershed Hydrological Models, Classification of Hydrological Models, Hydrological Processes: Surface Water, Hydrological Processes: Groundwater, Modelling Groundwater: Surface Water Interactions, Stream flow Estimation, Stream flow Routing, Lakes and Reservoirs, Estimating Active Storage Capacity

Unit:4 **[12-h]**

Flood Management: Introduction, State-wide flood management, General History, Other Considerations, Flood Frequency and Protection, The various river basins in state-wide, Problems and Solutions, Managing Risk, Storage, Discharge-Increasing Measures, Green Rivers, Use of Existing Water Courses, The Overall Picture, Dealing With Uncertainties, Interactions Among User Groups, Creating a Flood Management Strategy

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

Loucks, Daniel P., van Beek, Eelco “Water Resource Systems Planning and Management”, Springer publication.

Ref. Books

Sarah Luck “Water Resources Management”,Syrawood Publishing House.
ZiemiSka-Stolarska Aleksandra , Zbici Ski Ireneusz , Imbierowicz Miros Aw
Analysis of the System of Management Plans and Water Resources”, LAP Lambert Academic Publishing

Subject Code	Course title	L	T	P	C	QP
PE	**URBAN DRAINAGE AND SEWERAGE SYSTEM**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	To study urban hydrological cycle and sewerage system.
CO2	To estimate sewage generation and study different aspects of it.
CO3	To estimate storm water generation and study different aspects of it.
CO4	To impart knowledge of design of sewers and storm water drains.

Unit:1 **[12-h]**

Urban Hydrological Cycle, Effects of Urbanization on Catchment Hydrology, Need for Urban Drainage System, Planning Objectives, Interaction of Urban and Surrounding Areas, Approaches to Urban Drainage. Types of sewerage system: Combined system, Separate System, Partially separate system, Patterns of Collection System, Components of sewerage system, design and planning of sewerage systems.

Unit:2 **[10-h]**

Quantity estimation of Sewage: Sources of Sanitary Sewage, Dry Weather Flow, Evaluation of Sewage Discharge, Design Period, Design Discharge, Population forecasting

Unit:3 **[10-h]**

Quantity Estimation of Storm Water: Factors Affecting the Quantity of Storm water, Storm hyetographs – Rainfall excess calculations, time of concentration, Methods for Estimation of Quantity of Storm Water

Unit:4 **[12-h]**

Hydraulic Design of Sewers and Storm Water Drains: Difference Between Water Supply Pipes and Sewer Pipes, Requirements of Design and Planning of Sewerage System, Hydraulic Formulae for Determining Flow Velocities, Minimum and maximum Velocity, Hydraulic characteristics of circular sewer running full or partially full

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Environmental Engineering (Volume II) by S. K. Garg-Khanna Publishers

Ref. Books

1. Hall M.J. (1984), “Urban Hydrology”, Elsevier Applied Science Publishers
2. Geiger, W.F. Marsalek, J.Zudima and Rawls, G.J. (1987 “Manual on Drainage in Urban Areas”, 2 Volumes, UNESCO, Paris.)
3. Geiger, W.F. and Jayakumar, K.V. (Ed.) (1996) “Lecture Notes of the V International Course on Urban Drainage in Developing Countries”, Regional Engineering Collage, Warangal.
4. Wanielista, M.P. and Yousef, Y.A. (1993), “Stormwater Management”, John Wiley and Songs, Inc., New York.

Subject Code	Course title	L	T	P	C	QP
OE	**PROJECT MANAGEMENT**	3	0	0	3	A

Course Outcomes

Pre-Requisites (If any) –

CO1	Ability to understand basic concepts of project management
CO2	Ability to understand Project scheduling and Planning Tools
CO3	Ability to plan a project using CPM and PERT techniques
CO4	Ability to understand Time Cost Trade-off

Unit:1 **[10-h]**

Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization. Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management.

Unit:2 **[10-h]**

Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks. Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource Constraints: Resource Levelling and Resource Allocation.

Unit:3 **[08-h]**

Specific methodologies for planning: Critical Path Method (CPM); Precedence Diagramming Method (PDM); Program Evaluation and Review Technique (PERT); Graphical Evaluation and Review Technique (GERT); Queue - Graphical Evaluation and Review Technique (GERT); Simulation Language for Alternative Modelling (SLAM); Dynamic Planning and Control Methodology (DPM); Critical Chain Planning; Resource Loading.

Unit:4 **[08-h]**

Time Cost Trade-off: Crashing Heuristic. Project Implementation: Project Monitoring and Control with PERT/Cost, Contract Management, Project Procurement Management; Post Project Analysis. life-cycle and post-mortem analysis.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, PH Inc.
2. Lock, Gower, Project Management Handbook.

Ref. Books

1. Cleland and King, VNR Project Management Handbook.
2. Wiest and Levy, Management guide to PERT/CPM, PHI.
3. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
4. S. Choudhury, Project Scheduling and Monitoring in Practice.
5. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

Subject Code	Course title	L	T	P	C	QP
OE	**TOWN PLANNING AND ARCHITECTURE**	3	0	0	3	A

Course Outcomes

Pre-Requisites (If any) –

CO1	Ability to understand the functional role of elements for their judicious allocation in master plan.
CO2	Ability to understand Planning law & Legislation
CO3	Ability to understand the trend in Indian architecture.
CO4	Ability to understand architectural development.

Unit:1 **[10-h]**

Elements of City plan, Surveys, Zoning, Housing, Slums, Parks & Play grounds, Public buildings & Town centres and Industries

Unit:2 **[10-h]**

Communication & Traffic Control, Urban renewal & replanning the existing towns, Master plan, Planning law & Legislation.

Unit:3 **[10-h]**

Architecture as a fine art, its aim, importance and methods of study. Fundamental principles of architecture-Truth, beauty and Goodness.

Qualities and factors of beauty. Qualities : Strength, Viability, Restraint, Refinement, Repose, Grace, Breadth, Scale, Expression or setting out of purpose, Unity in concept, Factors : Mass, Form, Proportion, Balance, Symmetry, Solids, and voids, Light and shade.

Unit:4 **[10-h]**

Influence on architectural development: Effects of topography, Climate, Religion, Customs, Traditions, Technological development and aspirations of time.

Class in Orders: Definition, Doric, Ionic, Corinthian, Composite and Tuscan orders, Knowledge of the details of their parts and proportions.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

Fundamentals of town planning -G.K. Hiraskar - Dhanpat Rai & Publication

Ref. Books

1. Architects & Builders hand book – Kiddar& Parker
2. The great ages of world architecture - G.K.Hiraska

Subject Code	Course title	L	T	P	C	QP
OE	**GROUND IMPROVEMENT TECHNIQUE**	3	0	0	3	A

Course Outcomes

Pre-Requisites (If any) –

CO1	The students can understand the necessity of ground modification that can be done depending upon the site condition, type and purpose of structure to be constructed.
CO2	The students can understand the utilization of waste materials in the field.
CO3	The students can design geo-synthetics and geo-cells in construction work.
CO4	The students can understand about thermal modification.

Unit:1 **[8-h]**

Introduction: situations where ground improvement becomes necessary

Unit:2 **[12-h]**

Mechanical modification: dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, stone columns; Hydraulic modification: dewatering systems , preloading and vertical drains, electro-kinetic dewatering

Unit:3 **[8-h]**

Chemical modification; modification by admixtures, stabilization using industrial wastes, grouting

Unit:4 **[8-h]**

Thermal modification: ground freezing and thawing

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Ref. Books

1. Hausmann, M.R., Engineering Principles of Ground Modification, McGraw-Hill International Editions, 1990.
2. Yonekura, R., Terashi, M. and Shibazaki, M. (Eds.), Grouting and Deep Mixing, A.A. Balkema, 1966.
3. Moseley, M.P., Ground Improvement, Blackie Academic & Professional, 1993.
4. Xanthakos, P.P., Abramson, L.W. and Bruce, D.A., Ground Control and Improvement, John Wiley & Sons, 1994.
5. Koerner, R. M., Designing with Geosynthetics, Prentice Hall Inc. 1998.
6. Shukla, S.K., Yin, Jian-Hua, "Fundamentals of Geosynthetic Engineering", Taylor & Francis

Subject Code	Course title	L	T	P	C	QP
PC	**DESIGN OF HYDRAULIC STRUCTURES**	0	0	2	1	A

Course Outcomes	
CO1	Ability to design irrigation channels
CO2	Ability to design canal fall, cross drainage work, diversion head work
CO3	Ability to understand stability analysis of gravity dam and seepage analysis of earthen dam with spillway

a. Design of irrigation channels using Kenedy's theory and garret's diagram.
b. Design of irrigation channel using Lacey's theory.
c. Design of vertical drop type canal fall.
d. Design of cross drainage work (aqueduct, super passage)
e. Design of weir.
f. Design of barrage.
g. Design of canal head regulator.
h. Design of earthen dam.
i. Design of gravity dam.
j. Design of ogee spillway

Subject Code	Course title	L	T	P	C	QP
PC	**TRANSPORTATION ENGINEERING LAB**	0	0	2	1	A

Course Outcomes	
CO1	Ability to characterize subgrade SOIL
CO2	Ability to characterize coarse aggregate.
CO3	Ability to characterize bitumen.

1. Determination of aggregate crushing value
2. Determination of aggregate impact value
3. Determination of los Angeles abrasion value of aggregate
4. Determination of shape test of coarse aggregate
   a. Flakiness index
   b. Elongation index
5. Determination of water absorption of coarse aggregate
6. Determination of penetration value of bitumen
7. Determination of softening point of bitumen material
8. Determination of stripping value of coarse aggregate
9. Determination of ductility value of bitumen
10. Determination of flash & fire point test for bituminous sample
11. Determination of specific gravity of bitumen
12. Determination the strength (marshal stability value) and flexibility (flow value) for the given bituminous mixture.

Subject Code	**Course title**	**L**	**T**	**P**	**C**	QP
PC	**DESIGN OF STEEL STRUCTURES**	0	0	2	1	A

Course Outcomes	
CO1	Ability to design Plate Girder
CO2	Ability to design Gantry Girder
CO3	Ability to design Roof Truss

1. Types of steel sections and their properties
2. Design and detailing of tension members
3. Design and detailing of compression members
4. Design and detailing of lacing and battening system
5. Design and detailing of slab base and gusseted base
6. Design and detailing of beams and plate girders
7. Design and detailing of roof truss
8. Detailing of framed and bracket connections

VII SEMESTER

Subject Code	Course title	L	T	P	C	QP
PC	**ADVANCED STRUCTURAL ANALYSIS**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Understand the force and displacement methods of structural analysis and the use of slope deflection method and moment distribution method of analysis of indeterminate structures 2.analyze the indeterminate structures by Kani's method and the methods for analysis of two hinged arches, cables with stiffening girders
CO2	Analyze the methods for analysis of indeterminate structures due to rolling or moving loads and their maximum influence on indeterminate beams, two hinged arches, cables with stiffening girders
CO3	Understand plastic analysis of structures
CO4	Apply the basic concepts of flexibility and stiffness matrix methods in structural analysis

Unit:1 **[10-h]**

Introduction to Force and Displacement methods of structural analysis, Analysis of continuous beam and plane frame by slope deflection method and moment distribution method.

Unit:2 **[10-h]**

Two hinged arches and analysis of suspension cable with two hinged stiffening girders
Influence lines for indeterminate beams, influence lines for two hinged arches and stiffening girders.

Unit:3 **[10-h]**

Plastic Analysis: Plastic modulus, shear factor, plastic moment of resistance, load factor, Simple cases of beams and frames (continuous beam and simple rectangular portals), Application of upper and lower bound theorems

Unit:4 **[10-h]**

Matrix method of analysis: flexibility and stiffness method, Application to simple trusses and beams:
Flexibility Method: Equilibrium and compatibility – Determinate vs Indeterminate structures –
Indeterminacy – Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames.
Stiffness Matrix Method: Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations –Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Indeterminate Structures by C.K. Wang.
2. Matrix methods of Structural Analysis By Pandit and Gupta

Ref. Books

1. Indeterminate Structures by J.S. Kenney

Subject Code	Course title	L	T	P	C	QP
PC	**TRANSPORTATION ENGINEERING II**	3	0	0	3	A

Pre-Requisites (If any) –

Course Outcomes

CO1	To understand the Railway track components.
CO2	To understand the Geometric Elements.
CO3	Able to design Railway Turnout and signals.
CO4	To select feasible airport site, design of runway and taxiway and suitable air traffic control system.

Unit:1 **[12-h]**

History of Indian Railways, **Railway track & Component**- Permanent Way, Gauge, Track Structure, rails, rail joints, Wear and other defects in rail, creep of rail, Coning of wheels **Sleepers**- Function, Requirements and Classification, Sleeper Density. Ballast- Function, Requirements, Different materials used for ballast, Depth of ballast Cushion.

Unit:2 **[12-h]**

Traction, tractive effort and hauling capacity. **Geometric design**- Alignment, horizontal curves, super elevation, equilibrium cant and cant deficiency, Gradients and grade compensation, vertical curves. Point and Crossing- Turnout, Design of simple turn out, Crossing, various types of track junction and their configurations.

Unit:3 **[10-h]**

Signalling and interlocking: Objective and Classification, Control. Interlocking- Purpose, Principle and Methods. Train Control System.

Unit:4 **[12-h]**

Air Transport Development: Aircraft characteristics, Airport site selection, Imaginary surfaces.

Airport components: orientation and configuration, Basic runway length and corrections, Taxiway and Exit taxiway, holding aprons. Hangar, Terminal building. Visual Aids and Air Traffic Control: Airport making and lighting, Instrumental landing systems and Air navigation aids.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. A Text Book of Railway Engineering by S C Saxena and S P Arora, Dhanpat Rai & Sons
2. Airport Planning & design by S. K. Khanna, M.G. Arora & S. S. Jain- Nemchand& Bros.

Ref. Books

1. Railway Engineering, M.M. Agrawal, Prabha& Co., New Delhi
2. Railway Track Engineering by J. S. Mundrey, Tata McGraw Hill Book Co.

Subject code	course title	L	T	P	C	QP
PE	**ESTIMATION AND PROFESSIONAL PRACTICE**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to understand fundamentals of estimation and specifications
CO2	Ability of interpretation of structural drawing and quantity estimation
CO3	Ability to analyze rates of various items of work
CO4	Ability to understand concepts of contract and laws.

Unit:1 **[10-h]**

Introduction to estimation and specification: General introduction to quantity surveying: purpose of estimation; Types of estimates, various items to be included in estimates; Principles in selecting units of measurement for items, various units and modes of measurement for different trades, I.S. 1200. Specification: purpose and basic principles of general and detailed specifications; detailed specifications for various items of work.

Unit:2 **[10-h]**

Reading and interpretation of architectural and structural drawings: Taking out quantity, Measurement and abstract sheets and recording; detailed estimate of buildings, Preparation of schedule for steel as reinforcement. Approximate estimates: purpose, various methods used for buildings. Preparation of bills of quantities

Unit:3 **[10-h]**

Analysis of rates: factors affecting the cost of materials, labour; Task work, schedule as basis of labour costs; Plants and equipment: hour costs based on total costs and outputs. Transports, octroi; Overhead charges, rates for various items of construction of civil engineering works; Standard schedule of rate, price escalation

Unit:4 **[10-h]**

Contracts management: Legal aspects, Types of construction contracts; Tenders: tender form, submission and opening of tenders, measurement book, muster roll, piecework agreement and work order.

Disputes: Causes, types of dispute resolution mechanisms, dispute resolution by arbitration: advantages, procedure.

Construction laws: related to land acquisition, labour safety and welfare.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Ref. Books

1. Estimating and costing in Civil Engineering Theory & Practice, B.N.Dutta,
2. Estimating, Costing, Specification and Valuation on Civil Engineering, by M. Chakraborti
3. Construction Management and Planning, B. Sengupta& H Guha, Tata McGraw Hill

Subject code	course title	L	T	P	C	QP
PE	**ECONOMIC EVALUATION AND ANALYSIS OF TRANSPORT PROJECTS**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to assess the financial feasibility of the project.
CO2	Ability to analyse the impact on cash flow and revenue streams.
CO3	Ability to analyse the impact analysis – long-term impact of project on tax revenues
CO4	Ability to understand Economic Evaluation methods

Unit:1 **[12-h]**

Project Formulation: Project Preparation – Flow Chart for Project preparation. Project Cycle- Project Formulation – Need and Scope of Project Formulation - Various Aspects and Approaches in Project Formulation. Stages in Project Formulation. Preparation of Feasibility Report and DPR – Guidelines

Unit:2 **[14-h]**

Economic Evaluation: Need for Economic Evaluation; Stages involved in Economic Analysis; Cost and Benefit components; Discounting Criteria; Welfare economics; Social costs; Rate of Return; Road User Cost study in India ; Value of Travel time Savings - Economic concept of evaluation of travel time savings; Issues connected with evaluation of travel time savings. Vehicle operating costs - Components of VOC, Accident costs; Methodologies for economic evaluation of an accident.

Unit:3 **[10-h]**

Economic Analysis; Basic Concepts of Economic Analysis, Principles of Economic Analysis; Cash flow diagrams; Time value of Money; Development of cash flow Diagrams

Unit:4 **[12-h]**

Methods of Economic Evaluation -Equivalent Uniform Annual Cost Method; Present worth of cost method;- Equivalent uniform annual net return method; Net present value method; Benefit cost ratio method; Rate of Return Method. Applications of these methods to highway projects.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text. Books

1. IRC: SP: 19; 2001, Manual For Survey, Investigation & Preparation of Road Projects.
2. IRC:SP: 30, Manual on Economic Evaluation of Highway Projects in India.
3. Economic Analysis for Highways - Winfrey.R; International TextBook Company.

Ref. Books

1. Road User Cost Study, CRRI
2. Road Project Appraisal, for Developing Countries, J.W.Dickey ,John Wiley & Sons. 59

Subject code	course title	L	T	P	C	QP
PE	**STRUCTURAL DESIGN OF WATER AND SEWERAGE**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to understand various elements of water supply and sewerage treatment system
CO2	Ability to analyze and design pipes
CO3	Ability to design concrete roofing system for of water storage system
CO4	Ability to design water tanks

Unit:1 **[10-h]**

Elements of Water supply and sewerage treatment system: Intake structures; pipe materials; treatment system: aeration, coagulation, flocculation, sedimentation, filtration systems. Design principles.

Unit:2 **[10-h]**

Structural design of pipes: Design of concrete; pre-stressed concrete, steel, cast iron piping mains; sewerage tanks design; anchorage for pipes, massive outfalls, structural design and laying, manufacturing of pipes.

Unit:3 **[10-h]**

Design of concrete roofing systems: Cylindrical, Spherical, Conical shapes using membrane theory and design of various types of folded plates for roofing with concrete.

Unit:4 **[10-h]**

Design of circular, rectangular, spherical and Intze type of tanks using concrete. Design of pre-stressed concrete cylindrical tanks.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Ref. Books

Subject code	course title	L	T	P	C	QP
OE	**GREEN BUILDING**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to understand concept and process for design of green buildings
CO2	Ability to understand green building systems
CO3	Ability to know construction methods.
CO4	Ability for assessment of green buildings

Unit:1 **[14-h]**

GREEN BUILDING PROCESS AND ECOLOGICAL DESIGN

Fundamental Principles of Green Building, Introduction to high-performance green buildings, Conventional versus green building delivery systems - Design and construction relationships - Green building project execution - the integrated design process - green building documentation requirements - design versus ecological design - historical perspective - contemporary ecological design - future ecological design - green design to regenerative design.

Unit:2 **[14-h]**

GREEN BUILDING SYSTEMS Sustainable sites Design and landscaping – enhancing ecosystems - building envelop – selection of green materials - products and practices - passive design strategy – internal load reduction – indoor environment quality strategies - Building energy system strategies – Water cycle strategies- building water and waste management – relevance to LEED / IGBC standards.

Unit:3 **[12-h]**

GREEN BUILDING IMPLEMENTATION

Site protection planning - health and safety planning - construction and demolition waste management - reducing the footprint of construction operations - maximizing the value of building commissioning in HVAC System, lighting and non-mechanical Systems - costs and benefits relevance to LEED / IGBC standards.

Unit:4 **[12-h]**

ASSESSMENT TESCHNIQUES

Methods and tools for building assessment- USGBC LEED building assessment standard - LEED certification process – Green Globes building assessment protocol- international building assessment systems - LEED-NC Platinum / gold / silver building case studies – trends in building rating systems – IGBC standards – ECBC compliances.

Florida Green Building Coalition.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Jerry Yudelson, Green building A to Z, Understanding the buildings, 2008.
2. Green building guidelines: Meeting the demand for low-energy, resource efficienthomes. Washington, D.C.: Sustainable Buildings Industry Council,

Subject code	course title	L	T	P	C	QP
OE	**WATER POWER ENGINEERING**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to know about hydroelectric power generation
CO2	Ability to analyze stream flow data for water power studies and the ability to understand design of different components of hydropower plant
CO3	Ability to understand primary and secondary power
CO4	Ability to differentiate between thermal power and hydro power

Unit:1 **[12-h]**

Hydroelectric Power: Introduction, essential stream flow data for hydro- power studies, storage and pondage

Unit:2 **[13-h]**

Essential stream flow data for water power studies, Flow duration curve, Flow mass curve

Classification of hydro-power plants, principal components of a hydro-power plant, important terms and definitions connected with hydro-power

Unit:3 **[10-h]**

Primary and secondary power, load factor, utilization factor and capacity factor, assessment of available power

Unit:4 **[12-h]**

Thermal power and hydropower, comparison of hydro power with thermal power costs with reference to Indian conditions, typical hydro-electric power developments in India, hydro-power potentials in India and the World

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

P. N. Modi, S. M. Seth (2002) “Hydraulics And Fluid Mechanics Including Hydraulics Machines”, Standard Book House.

Ref Books

VIII SEMESTER

Subject code	course title	L	T	P	C	QP
PE	**CONSTRUCTION MANAGEMENT**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to identify different aspects of project management
CO2	Ability to optimize the cost and time of a Project by using CPM & PERT Techniques
CO3	Ability to select the suitable equipments and materials required for the execution of a project and to solve optimization problem
CO4	Ability to describe material procurement method and control for a project

Unit:1 **[14-h]**

Types of construction projects, Objectives and functions of construction management. Project Management: Project Planning, Scheduling and Controlling, **Bar charts**: Development of Bar charts and its shortcomings. **Network techniques:** Event, activity, Dummy activity. Network rules, Numbering of events. Critical Path Method, Critical activities, Slack. Project Evaluation and Review Techniques (PERT): Time estimates, Different types of Float of activity. Probability of meeting schedule date for the project

Unit:2 **[12-h]**

Cost Model: Project cost, indirect and direct cost, slope of direct cost curve, optimum project duration, contracting the network for cost optimization. Introduction to updating, resources smoothing and resources levelling

Unit:3 **[14-h]**

Construction equipments: Different types of construction equipments, earth moving, dewatering and pumping, grouting, pile driving equipments. Conveyors, cranes, concrete mixture, vibrators, Rollers, Compactors and other road construction equipments. Factors affecting selection of construction equipments. Safety and safety measures in construction works. Quality control

Unit:4 **[10-h]**

Introduction to optimization. Linear system: graphical method, simplex method. Sensitive analysis. Dynamic programming.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Construction planning, Equipments and Methods, R. L.Peurify. Tata McGraw Hill
2. Construction Management and Planning, B Sengupta& H Guha, Tata McGraw Hill
3. Construction Planning and Management, Mahesh Verma
4. PERT & CPM, L. S. Sreenath. East - West Press.
5. Optimization, S.S. Rao, Tata Mc Graw Hill

Ref Books

Subject code	course title	L	T	P	C	QP
PE	**PAVEMENT MANAGEMENT SYSTEM**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to design flexible pavement by various methods.
CO2	Ability to design rigid pavement by various methods.
CO3	Ability to check Pavement Performance.
CO4	Ability to understand Pavement rehabilitation techniques

Unit:1 **[14-h]**

Components of PMS and their activities; Major steps in implementing PMS; Inputs; Design, Construction and Maintenance; Rehabilitation and Feedback systems; Pavement Maintenance Management Components of Maintenance Management and Related Activities
– Network and Project Level Analysis; Prioritization Techniques and Formulation of Maintenance Strategies.

Unit:2 **[12-h]**

Techniques for functional and structural evaluation of pavements: Serviceability Concepts; Visual Rating; Pavement Serviceability Index; Roughness Measurements ;Distress Modes – Cracking, Rutting, etc; **Pavement Deflection** – Different Methods and BBD, Skid Resistance,
Roughness, Safety – Aspects; Inventory System. Causes of Deterioration, Traffic and Environmental Factors

Unit:3 **[12-h]**

Pavement Performance Modelling Approaches and Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance; Quality Control – ISO 9000, Sampling Techniques – Tolerances and Controls related to Profile and Compaction

Unit:4 **[10-h]**

Pavement rehabilitation techniques: overlay design procedures, recycling of flexible and rigid pavements

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Y. H. Huang, Pavement Analysis and Design, Seconded.,Pearson Education
2. Rajib B. Mallick,Tahar El-Korchi, Pavement Engineering: Principles and Practice,

Ref Books

1. Ralph Haas, W. Ronald Hudson, John P. Zaniewski, Modern pavement management Modern Pavement Management, Krieger Pub Co 60
2. Croney, D. and P. Croney, The design and performance of road pavements, McGraw-Hill Book Company, London, UK.
3. Derek Pearson, Deterioration and Maintenance of Pavements, ICE Publishing
4. IRC: 81-1997 Guidelines for strengthening of flexible pavement.

Subject code	course title	L	T	P	C	QP
PE	**TRAFFIC ENGINEERING & MANAGEMENT**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to conduct traffic survey collects data, analyse and interpret them.
CO2	Ability to manage Parking
CO3	Ability to analyse LOS of an operating highway.
CO4	Ability to design of signal and manage the traffic.

Unit:1 **[14-h]**

Traffic Studies: Basic characteristics of Traffic, Volume, Speed and Density; Definitions and their interrelationships; Traffic Volume studies - Objectives, Methods of Volume counts, Presentation of Volume Data;

Speed studies- Types of Speeds, Objectives, Methods of speed studies, Statistical Methods for speed data Analysis, Presentation of speed data. Delay Studies; Head ways and Gap Studies - Headway and Gap acceptance, Origin and Destination Studies.

Unit:2 **[12-h]**

Parking Studies: parameters of parking, definitions, Parking inventory study, Parking survey by Patrolling method; Analysis of Parking Survey data; Accident studies- Causative factors of Road accidents, Accident data collection: Accident analysis and modelling; Road Safety Auditing, Measures to increase Road safety.

Unit:3 **[12-h]**

Capacity and LOS Analysis: Introduction to Traffic capacity Analysis, Concepts of Level of Service, Basic definitions, Factors affecting Capacity and LOS, Capacity of Urban/Rural Highway, With or without access control, Basic freeway segments - Service flow rate of LOS, Lane width or Lateral clearance adjustment; Heavy vehicle adjustment; Driver population adjustment.

Unit:4 **[12-h]**

Signal Designing – Fixed Time signals, Determination of Optimum Cycle length and Signal setting for Fixed Time signals, Warrants for Signals, Time Plan Design for Pre-Timed Control- Lane group analysis, Saturation flow rate, and Adjustment factors, Uniform and Incremental Delay, Vehicle Actuated Signals, Signal Coordination.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Transportation Engineering - An Introduction - C.JotinKhisty, Prentice Hall Publication
2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers

Ref Books

1. Traffic Engineering - Theory & Practice - Louis J.Pignataro, Prentice Hall Publication.
2. Traffic Engineering by Roger P.Roess, William R. Mc. Shane, Elena S.Prassas, PrenticeHall, 1977.
3. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India
4. Fundamentals of Traffic Engineering – McShane & Rogers.
5. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski,John Wiley & Sons Publication
6. IRC Codes
7. Highway Capacity Manual -2010.

Subject code	course title	L	T	P	C	QP
PE	**GROUND WATER ENGINEERING**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to know about occurrence of groundwater
CO2	Ability to understand movement of groundwater
CO3	Ability to understand well hydraulics
CO4	Ability to analyze environmental influences on groundwater levels

Unit:1 **[14-h]**

Introduction: Ground water theories, Trends in withdrawal and utilization of ground water, Ground water in hydrologic cycle, Hydrologic budget

Occurrence of groundwater: Origin and age of ground water, rock properties affecting ground water, vertical distribution of ground water, zone of aeration, zone of saturation, geologic formations as aquifers, types of aquifers, storage coefficient, ground water basins, springs, hydrothermal phenomena, groundwater in permafrost regions

Unit:2 **[12-h]**

Groundwater movement: Darcy's law, permeability, determination of hydraulic conductivity, anisotropic aquifers, groundwater flow rates, groundwater flow directions, dispersion, groundwater tracers, general flow equations, unsaturated flow, kinematic wave, the Green-Ampt method for infiltration estimation

Unit:3 **[14-h]**

Wells: Test holes and well logs, testing wells for yield, total pumping head of well, horizontal wells, characteristic well losses and their evaluation, specific capacity and efficiency of well, well-skin effect

Groundwater and well hydraulics: Steady unidirectional flow, steady radial flow to a well, well in a uniform flow, unsteady radial flow in a confined aquifer, unsteady radial flow in an unconfined aquifer, unsteady radial flow in a leaky aquifer, location of aquifer boundary and

well flow near aquifer boundary, multiple well systems, partially penetrating wells, well flow for special condition

Unit:4 **[14-h]**

Environmental influences on groundwater levels: Time variation of groundwater levels, stream flow and groundwater levels, groundwater level fluctuations due to evapotranspiration, meteorological phenomena and tide, urbanization, earthquake, external load, land subsidence and global climate change influences on groundwater levels Groundwater flow modelling: Groundwater flow models (definition and types), cause of development and steps in development of groundwater flow models

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Todd, D.K., Mays, L.W. "Groundwater Hydrology", Wiley.
2. Raghunath, H.M. "Groundwater" New Age International Publisher
3. Mahajan, G. "Evaluation and Development of Groundwater" APH.
4. Agarwal, V.C. "Groundwater Hydrology", PHI Learning Pvt. Ltd.

Ref Books

Subject code	course title	L	T	P	C	QP
PE	**ENVIRONMENTAL GEOTECHNIQUE**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	To understand the principles and methods of civil engineering (geo-technics) and its relation to environment
CO2	To analyze and able to find various engineering properties of wastes.
CO3	To study about subsurface contamination and different remediation process.
CO4	To know the primary considerations for design, constructions, quality control and risk Assessment.

Unit:1 **[10-h]**

Sources and Site Characterization: Scope of Environmental Geotechnics, Various Sources of Contaminations, Need for contaminated site characterization; and Characterization methods.

Unit:2 **[10-h]**

Solid and Hazardous Waste Management: Classification of waste, Characterization solid wastes, Environmental Concerns with waste, waste management strategies.

Unit:3 **[10-h]**

Contaminant Transport: Transport process, Mass-transfer process, Modelling, Bioremediation, Phytoremediation.

Unit:4 **[10-h]**

Remediation Techniques: Objectives of site remediation, various active and passive methods, remediation NAPL sites, Emerging Remediation Technologies, Geosynthetics: Types, Functions and Design.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination - Prentice Hall Publications, 4th Edition, 2008
2. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)

Ref Books

1. Rowe, R. K. - Geotechnical &Geoenvironmental Engineering Handbook, Kluwer Academic, 2001.
2. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York, 2000.
3. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001

Subject code	course title	L	T	P	C	QP
PE	**PRESTRESSED CONCRETE**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes and determine the prestressing force required in beam for a prestressing systems.
CO2	Find out losses and deflections in the prestressed concrete.
CO3	Compute the Flexural Strength, Shear strength & Torsional Resistance of prestressed Concrete Members.
CO4	Design of end blocks for prestressed members.

Unit:1 **[14-h]**

Introduction to prestressed concrete: types of prestressing, systems and devices, materials. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.

Unit:2 **[14-h]**

Losses in pre tensioned and post tensioned members. Deflection of prestressed concrete structures- short term as well as long term deflections of uncracked and cracked members

Unit:3 **[14-h]**

Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.

Unit:4 **[14-h]**

Anchorage zone stresses for post tensioned Members; Magnel's method, Guyon's method, Rowe's method and IS code method of design.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Prestressed Concrete, Raju,N.K., Tata McGraw Hill
2. Prestressed Concrete, T. Y. Lin

Ref Books

Subject code	course title	L	T	P	C	QP
OE	**FINITE ELEMENT METHOD**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	Ability to reproduce the basic knowledge of mathematics, science and engineering in the areas of finite element analysis related to structural engineering.
CO2	Ability to identify, formulate and solve engineering problems of structural engineering related to one and two dimensional structures.
CO3	Ability to analyse structures using isoperimetric elements
CO4	Ability to solve plate bending problems

Unit:1 **[12-h]**

The Continuum, Equations of Equilibrium, Boundary Conditions, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems, Different methods of structural analysis including numerical methods. Basics of finite element method (FEM), different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach, Weighted residual Method.

Unit:2 **[14-h]**

One and Two Dimensional Problems: Detail formulation including shape functions, stress strain relations, strain displacement relations and derivation of stiffness matrices using energy approach, Assembling of element matrices, application of displacement boundary conditions, Numerical solution of one dimensional problems using bar, truss, beam elements and frames. Derivation of shape function using Lagrange's interpolation, Pascal's triangle, Convergence criteria, Finite Element modelling of two dimensional problems using Constant strain Triangle (CST) elements, Stress strain relations for isotropic and orthotropic materials, Four nodded rectangular elements, axisymmetric solids subjected to axisymmetric loading.

Unit:3 **[10-h]**

Isoparametric Elements: Natural coordinates, Isoparametric elements, four node, eight node elements. Numerical integration, order of integration

Unit:4 **[10-h]**

Plate Bending: Bending of plates, rectangular elements, triangular elements and quadrilateral elements, Concept of 3D modelling.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. C.S. Desai and J.F. Abel, Introduction to the Finite Element Method: CBS Publishers
2. R. D. Cook., Concepts and Applications of Finite Element Analysis, Wiley.

Ref Books

1. Logan, D. L., A First Course in the Finite Element Method, PWS Publishing, Boston,
2. O. C Zienkiewicz .and R. L. Taylor, Finite Element Method, Mc Graw Hill

Subject code	course title	L	T	P	C	QP
OE	**ENVIRONMENTAL MANAGEMENT**	3	0	0	3	**A**

Pre-Requisites (If any) –

Course Outcomes

CO1	To study the principles of environmental management.
CO2	To understand environmental impact prediction, evaluation and mitigation.
CO3	To identify and review audit-related documentation, prepare checklists and audit process
CO4	To apply tools such life cycle assessment, environmental audits, evaluation of environmental performance for environmental decision-making.

Unit:1 **[12-h]**

Principles of Environmental Management, Ecosystem Concepts, Environmental Concerns in India, Policy and Legal Aspects of Environmental Management, Introduction to Environmental Policies, Environmental Laws and Legislations, Environmental Legislations in India.

Unit:2 **[14-h]**

Environmental Impact Assessment (EIA), Impact Prediction, Evaluation and Mitigation, Forecasting Environmental Changes, Strategic Environmental Assessment (SEA), Environmental Clearance Procedure in India, EIA Documentation and Processes, EIA Monitoring and Auditing.

Unit:3 **[10-h]**

Environmental Auditing, Elements of Audit Process, Waste Audits and Pollution Prevention Assessments, EA in Industrial Projects.

Unit:4 **[10-h]**

Life Cycle Assessment (LCA), Stages in LCA of a Product, Procedures for LCA, Different Applications of LCA. Sustainable approach towards Environment Management, Environmental Protocols

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Vijay Kulkarni and Ramachandra T.V., 2006. Environmental Management, Commonwealth of Learning, Canada and Indian Institute of Science, Bangalore.

Ref Books

1. Lohani B.N (1984)., “Environmental Quality Management”, South Asian Publishers, New Delhi
2. Chanlett, (1973) “Environmental Protection”, McGraw Hill Publication, New York.
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