SGGS Institute of Engineering &Technology, Nanded
(Government Aided Autonomous Institute)
Department of Civil Engineering

Final Year B.Tech (Civil Engineering) SYLLABUS

CHOICE BASED CREDIT SYSTEM

EFFECTIVE FROM : 2018-2019

SGGS Institute of Engineering &Technology, Nanded
(Government Aided Autonomous Institute)
Department of Civil Engineering

Final Year B.Tech. (Civil Engineering) Curriculum Structure
Academic year 2018-19 onwards

Program Education Objectives (PEOs)

The Graduates will be able to:

PEO1	Pursue a successful career in the diversified sectors of the engineering industry and/or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals.
PEO2	Analyze and design Civil engineering systems with social awareness and responsibility.
PEO3	Exhibit professionalism and ethical approach through leadership, team work, good communication skills, and adapt to modern trends by engaging in lifelong learning.

Program Outcomes (POs)

On successful completion, graduates will be able to:

PO1	Apply knowledge of mathematics, science and engineering to civil engineering problems.
PO2	Identify, formulate and solve civil engineering problems.
PO3	Design various structures or particular system that meets desired specifications and requirements.
PO4	Design and conduct experiments, interpret and analyze data, synthesize the information to derive conclusions.
PO5	Select and use appropriate engineering techniques and software tools to analyze civil engineering problems with understanding of their applicability and limitations.
PO6	Assess local and global impact of societal issues on civil engineering profession.
PO7	Able to understand the impact of engineering solutions on society and demonstrate the knowledge for sustainable development.
PO8	Demonstrate their professional and ethical responsibilities.
PO9	Able to function as a member or a leader on engineering and science teams in various areas of civil engineering.
PO10	Communicate effectively in both verbal and written forms.
PO11	Understand and practice engineering and management principles.
PO12	Adapt transformations in industry through independent and lifelong learning.

Program Specific Outcomes

PSO1: Establish a Civil Engineering career in industry, government or academic field and achieve professional expertise as appropriate.
PSO2: Execute innovation and excellence in Civil engineering problem solving and design in global and societal contexts.
PSO3: Commit to lifelong learning and professional development in the Civil Engineering field to stay updated in technology, research topics and contemporary issues.
PSO4: Understand the fundamentals of Civil Engineering in commercial contexts and in expediting construction projects.

PO/PSO ⇒ / ⇓ PEO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
I	✓	✓	✓	✓	✓	--	--	--	✓	✓	--	--	✓	✓	--	✓
II	✓	✓	✓	✓	✓	✓	✓	--	✓	--	✓	✓	--	✓	✓	✓
III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

SEMESTER - VII

Course Code	Course Title	Contact Hours			Credits		Category Code
		Lectures	Tutorials	Practical	Th.	Pr.	
CE401	Design of Structures-III	03	--	02	03	01	PCC
CE402	Foundation Engineering	03	--	--	03	--	PCC
CE403	Professional Practice	03	--	02	03	01	PCC
CE404	Elective-I	03	--	--	03	--	DEC
CE405	Elective-II	03	--	--	03	--	DEC
CE406	Seminar	--	--	02	--	01	MDC
Sub Total:		15	--	06	15	03	
Total		**21 hrs**			**18**		

SEMESTER - VIII

Course Code	Course Title	Contact Hours			Credits		Category Code
		Lectures	Tutorials	Practical	Th.	Pr.	
CE407	Project (Industry/In-house)	--	--	32	--	16	PRC
Sub Total:		--	--	32	--	16	
Total		**32 hrs**			**16**		

ELECTIVE – I		ELECTIVE - II	
CE404A	Advanced Structural Analysis	CE405A	Town and Country Planning
CE404B	Advanced Geotechnical Engineering	CE405B	Traffic Engineering and Control
CE404C	Construction Management	CE405C	Open Channel Hydraulics
CE404D	Hydropower Engineering	CE405D	Water Conservation & Management
CE404E	Remote Sensing and GIS	CE405E	Operation Research

Final Year (Civil WM)	Contact Hours	Credits
TOTAL	**53**	**34**

- The evaluation of 'Theory Course' Shall be continuous and consist of In-semester Evaluation I (ISE-I) of 10 Marks, Mid Term Examination (30 Marks), In semester Evaluation II (ISE-II) of 10 Marks and End Term Examination (50 marks) as per the academic Calendar of the institute.

- The evaluation of term work (practical examination) shall be continuous as per the academic Calendar of the institute.

- Student can register for more courses other than prescribed (May be from other department or open electives) as per his/her interest and those credits will be treated as over and above

SEMESTER - VII

CE401- DESIGN OF STRUCTURES – III (L-03; P-1) (Credits-4)

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

CO1	Recall the fundamentals of strength of material and concrete technology.
CO2	Understand the basic concepts of structural design methods of RCC and PSC to solve the practical problem.
CO3	Apply the concepts and applications of RCC and PSC in real practical problems.
CO4	Analysis and design of RCC and PSC elements.
CO5	Formulate design philosophy for any given RCC and PSC structures.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	--	--	--	--	--	--	--	--	--	--
CO2	1	2	1	--	--	1	--	--	--	--	3	--
CO3	3	2	--	--	--	1	--	--	--	--	--	--
CO4	2	2	3	--	--	2	--	--	1	--	--	--
CO5	1	--	3	3	--	--	--	--	--	--	--	--

1: Slightly 2: Moderately 3: Substantially

PART – A: REINFORCED CEMENT CONCRETE

Unit 1. Working stress method: Introduction, flexure analysis and design of various R.C.sections. (07 hrs)

Unit 2. Water Tanks**:** Circular water tanks with flexible & rigid bases resting on ground, rectangular water tanks resting on ground & underground.
(07 hrs)

Unit 3. Flat Slabs**:** Design of flat slab with or without drop -direct design method.
(07 hrs)

PART – B: PRESTRESSED CONCRETE

Unit 4. Fundamentals of pre-stressing: Introduction to pre-stressed concrete, basic concept and general principles, materials used and their properties, methods and techniques of pre-stressing
(07 hrs)

Unit 5. Pretension and post tensioning- losses of prestress.
(07 hrs)

Unit 6. Flexure analysis design of PSC sections**:** cable profile limiting zone, shear & bond-End block design.(07 hrs)

TERM WORK: (P-02)

Term Work shall consist of the following:

1. Design and drawing of circular water tanks.
2. Design and drawing of underground and on ground rectangular water tank
3. Design and drawing of PSC girder with end block design.
4. Computer aided design of PSC beams (min.2)

TEXT BOOKS:

1. RCC designs :Pillai Tata McGraw Hill Pub.
2. Prestressed Concrete by Krishna Raju
3. RCC designs by Umat& Jain
4. Plain and Reinforced Concrete Vol. I, Jain &Jaikrishna, Nemchand.
5. Design of Reinforced Concrete Structures, Dayaratnam P, Oxford & IBH.
6. Reinforced Concrete Structures, Sayal&Goel, Wheeler.
7. Design of Pre-stressed Concrete Structures, T. Y. Lin & N. H. Burns
8. Pre-stressed Concrete, R. H. Evans & E.W. Bennet.
9. Modern Pre-stressed Concrete, James Libby

CE402- FOUNDATION ENGINEERING (L-3) (Credits-3)

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

CO1	Recall the fundamentals of building construction and geotechnical engineering.
CO2	Identifying the applicability of different foundation design applicable to various types of soil.
CO3	Apply the different design philosophy of foundation applicable to soil.
CO4	Analysis various types of shallow and deep foundations.
CO5	Create understanding applicability of foundation design for different types of soil.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	--	--	--	--	--	--	--	--	--	--
CO2	--	3	--	--	--	1	--	--	--	1	--	--
CO3	1	--	3	1	--	--	--	--	--	--	1	--
CO4	--	1	--	1	--	3	--	--	3	--	--	--
CO5	--	--	--	--	--	--	--	--	--	1	2	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Site investigation: Introduction, General requirements to be satisfied for satisfactory performance of foundations, Soil exploration: Necessity, Planning, Exploration Methods, Soil Sampling Disturbed and undisturbed, Rock Drilling and Sampling, Core Barrels, Core Boxes, Core Recovery, Field Tests for Bearing Capacity evaluation, Test Procedure & Limitations (6 Lectures)

Unit 2. Bearing Capacity**:** Theoretical Bearing Capacity Analysis - Failure Modes, Terzaghi's Analysis, Specialization of Terzaghi's Equations, Skempton Values for Nc, Meyerhof's Analysis, I.S. Code Method of Bearing Capacity Evaluation, Effect of Water Table, Eccentricity of load, Safe Bearing Capacity and Allowable Bearing Pressure, Settlement Analysis: Causes and control of settlement, immediate settlement, consolidation settlement, differential settlement, prediction of foundation settlement from plate load test, settlement tolerance of superstructures. (8Lectures)

Unit 3. Foundation on Black Cotton Soil: Foundation Construction in Difficult Soils - Guidelines for Weak and Compressible Soils, Expansive soil, Parameters of Expansive Soils, Collapsible Soils and

Corrosive Soils, Causes of Moisture changes in Soils, Effects of Swelling on Buildings, Preventative Measures for Expansive Soils, Modification of Expansive Soils, Design of Foundation on Swelling Soils, Ground Improvement Methods: Improvement of Cohesive Soils, Improvement of Cohesionless Soils, General Methods for Ground Improvement (7Lectures)

Unit 4. Shallow Foundations: Assumptions & Limitations of Rigid Design Analysis, Safe Bearing Pressure, Settlement of Footings, Design of Isolated, Combined, Strap Footing (Rigid analysis), Raft Foundation (Elastic Analysis), I. S. Code of Practice for Design of Raft Foundation. (6 Lectures)

Unit 5. Deep foundations: Pile Foundation: Classification, Pile Driving, Load Carrying Capacity of Piles, Single Pile Capacity, Dynamic Formulae, Static Formulae, Pile Load Tests, Penetration Tests, Negative skin Friction, Under Reamed Piles, Group Action of Piles,

Caissons Foundations: Box, Pneumatic, Open Caissons, Forces, Grip Length, Well Sinking, Practical Difficulties And Remedial Measures
Sheet Piles: Classification, Design of Cantilever Sheet Pile in Cohesionless and Cohesive soils. Design of Anchored Sheet Pile by Free Earth Support Method,
Cellular Cofferdams: Types, Cell Fill Stability Considerations (8 Lectures)

Unit 6. Lateral Earth Pressures Theories: applications of earth pressure theories, different types of earth pressure at rest, active and passive pressure. Rankine‟s Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure Planes for cohesion-less and cohesive soils. Coulomb's Wedge Theory: Coulomb's active pressure in cohesion-less soils, expression For active pressure, Coulomb's passive earth pressure. Rebhann's Construction for Active Pressure, Culmanns graphical solutions for active soils, Wedge Method, passive pressure by friction circle method for cohesion-less and cohesive soils.
Earth Retaining Structures- Rigid and flexible retaining structures, stability analysis of retaining walls, cantilever retaining Walls, construction details, drainage and wall joints. (8 Lectures)

TEXT BOOKS:

1. Teng W.C., "Foundation Design", Prentice-Hall Inc
2. Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall; 7th edition
3. Lee, "Sheet Piles" Concrete Publication,1961
4. Relevant Publications by Bureau of Indian Standards, New Delhi
5. IS 6403:1981, IS 1904:1986, IS 4091:1979

CE403 -PROFESSIONAL PRACTICE (L-3; P-1) (Credits-4)

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

CO1	Recall the fundamentals of building construction, building planning and computer aided drawing and environmental engineering
CO2	Understand the process to be followed for submission of any contract for government, semi government and private project.
CO3	Apply the basic knowledge acquired through subject for submission of any contract and its execution.
CO4	Analysis different type of contract in connection with estimation, specification, valuation and quantity surveying.
CO5	Propose the bill of quantities using different techniques of preliminary & detailed estimation of buildings & other structures.

Mapping of course outcomes with programme outcomes

Course Outcoms	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	1	--	--	--	--	--	--	--	--
CO2	1	--	--	--	--	--	--	--	1	--	3	--
CO3	3	3	--	1	--	1	--	--	1	--	--	--
CO4	1	2	--	1	--	1	--	--	1	--	--	--
CO5	--	--	1	--	1	--	--	2	--	--	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Introduction of IS-1200**:** For Modes of Measurements. Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Earthwork Calculations

Taking out quantities: Methods of Taking Out Quantities, PWD Method, English Method, Estimates of Buildings, Slab, Pipe Culvert, Septic Tank, Walls, Roads, Railway Tracks, and Canals.Plumbing Works, RCC Slabs and Framed Structures.water storage tank, Trusses of steel, Industrial Shed. Abstracting. (07 hrs)

Unit 2. Analysis of rates: Analysis of Rates for Various Items of Construction. Introduction of District Schedule of Rates. Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment.

Approximate estimates: Methods of Preparing Approximate Estimates for Building, Road, Bridges, Water Supply Schemes, Sewerage Schemes &Irrigation Schemes Approximate estimates- importance, purpose, different methods. Use of CBRI Equations for the same. (07 Hrs)

Unit 3. Specifications: Detailed specification (Reference to be made to PWD handbook and IS. 1200) for typical Civil Engineering works. Brief specifications. Principles of writing specifications. Types, requirements and importance, detailed specifications for the buildings, roads, minor bridges and industrial structures.

Contracts: Various Agencies Involved In Construction Industry. Essentials of valid contracts. Contract Documents. Conditions of Contract. Role of Engineer in Govt. Works in Contract. Role of Architect/ Civil Engineer in Semi Govt. and Private Organizations. Performance of Contract. Breach of Contract, Termination of Contract. **(**07 Hrs)

Unit 4. Types of Contract: Item Rate, Percentage Rate, Lump Sum, Cost plus Percentage. Cost Plus Fixed Fee, Target, and Piece.

Tender**:** Definition, Tender Notice, Earnest Money, Security Deposits, Preparation and Submission of Security and Acceptance of Tenders. (07 Hrs)

Unit 5. Government Procedure for Execution of Works: Classification of Works, Administrative Approval, Technical Sanction, Bills, Measurements Book, Muster Roll, Accounts of Works and Stores, Tools And Plants, Materials at Site Account, Daily Diary. U**se of computers in quantity surveying.** (05 Hrs)

Unit 6. Valuation: Definition, Nature of Value Factors Affecting Value of Land And Buildings, Salvage Value, Book Value, Market Value, Prospective Value, Sinking Fund, Depreciation, Methods of Working out Sinking Fund Installation & Depreciation, Methods of Valuation for Buildings.
Properties: Definition, Mortgage, Amortization, Arbitration, Sale of Real and Immovable Properties, Registration Sale Dead. Formation of Co-Operative Housing Societies and Related Procedure for Execution and Construction of Apartment, Act. (08 Hrs)

TERM WORK (P-2)

Term-work shall consist of the following.

1. Estimate of a two storied building
2. Estimate of a culvert or railway track or canal or road
3. Estimate of a simple RCC framed structure/ Industrial steel structures.
4. Analysis of rates for ten items of construction.
5. Specifications for six items of construction.
6. Valuation report for a building.

TEXT BOOKS:

1. Civil Engineering Contract and Estimates by B. S. Patil
2. Estimating and Costing in Civil Engineering by B. N. Dutta.
3. Elements of estimating and costing by S. C. Rangwala.
4. M Chakravarty, Estimating, Costing Specifications & Valuation
5. Joy P K, Handbook of Construction Management, Macmillan
6. B.S. Patil , Building & Engineering Contracts
7. Relevant Indian Standard Specifications.
8. World Bank Approved Contract Documents.
9. FIDIC Contract Conditions.

CE404- ELECTIVE – I (L-3) (Credits-3)

CE404 (A) - ADVANCED STRUCTURAL ANALYSIS (L-3) (Credits-3)

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

CO1	Recall the fundamentals of TOS-I and TOS-II.
CO2	Understand the basics of direct stiffness method in the analysis of structural components.
CO3	Apply the different methods of analysis of structural components in practical problems and Earthquake Analysis of structures
CO4	Analysis of plane frames, plane grids, plane trusses using basic knowledge of direct stiffness method and analysis of structures using IS:1893.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	--	--	--	--	--	--	--	--	--
CO2	--	--	1	1	--	1	--	--	1	--	3	--
CO3	3	1	--	--	1	--	--	1	--	--	--	--
CO4	1	2	--	1	--	1	--	--	1	--	1	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Basic concept, Degree of Freedom, Basic concept of Direct Stiffness Method. Formulation of elemental/local stiffness matrix and global stiffness matrix for plane truss. Transformation Matrix, Assembly of Global/ Structural stiffness matrix up to (8x8). Member load matrix including lack of fit, temperature, Assembly of Global/ Structure load matrix, Solution to problems with maximum degree of freedom three. (8 hrs)

Unit 2. Formulation of element/local stiffness matrix and global stiffness matrix for beam members (without axial deformations) for continuous beams, Transformation matrix Assembly of global/ structural stiffness matrix, Member load matrix due to concentrated loads, uniformly distributed Loads, Assembly of global/ structure load matrix up to Three Elements. Solution to problems with maximum degree of freedom Three. (8 hrs)

Unit 3. Formulation of element/ local stiffness matrix and global stiffness matrix for Plane frame members (without axial deformations), Transformation matrix Assembly of global/ structural stiffness matrix, Member load matrix due to concentrated loads, uniformly distributed Loads, temperature Moments Assembly of global/ structural load matrix. Solution to Plane frame problems with maximum degree of freedom six inclined member problems. (8 hrs)

Unit 4. Matrix method of analysis for plane grids Analysis of Symmetrical & Unsymmetrical plane Grids, space trusses using stiffness approach subjected to member loading (UDL, Conc. Load, Temperature etc.) and joint loads. (7 hrs)

Unit 5. Introduction to sturctural dynamics, Basis concepts, D'Alemberts Principle, equation of Motion of the Basis Dynamic System, Effect of Gravitation force, Influence of Support Excitation, Analysis for Free & Forced Damped/ undamped vibrations for SDOF only, Transmissibility ratio, Response to Harmonic Loading. (7 hrs)

Unit 6. Earthquake Analysis of structures using IS:1893 : Introduction to Earthquake code, Calculation of earthquake forces on building using coda coefficient method. (7 hrs)

TEXT BOOKS:

1. Matrix Method of Structural Analysis - Gere and Weaver
2. Computer Analysis of Structures - Beaufait, Rowen, Headly et al
3. Structural Dynamics- Clough &Penzin
4. Computational Structural Mechanics, S Rajasekaran& G Sankarasubramanian
5. Computer Analysis of Structures – Flemmings

CE404 (B) Advance Geotechnical Engineering– (L-3) (Credits-3)

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

CO1	Remember the fundamentals of Geotechnical Engineering.
CO2	Understand behaviour of different engineering properties of soil.
CO3	Apply different soil improvement techniques applicable to soil.
CO4	Analyse the soil subjected to liquefaction.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	--	--	--	--	--	--	--	--	--
CO2	1	--	1	--	--	--	--	1	--	--	3	--
CO3	3	--	--	2	--	1	--	--	--	1	--	--
CO4	1	--	--	2	--	--	--	--	1	--	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Expansive Soils: Origin and classification of clay minerals, Mechanism of swelling recognition & identification of expansive soil. Free swell indices, ground heave, swelling pressure & swelling potential, factors affecting expansivity and swelling pressure of soil, properties and uses of benotonite slurry, design approaches for foundations in swelling soil, introduction to CNS technique, Swelling shrinking of clays identification of clay minerals by x-ray diffraction and DTA methods.

Unit 2. Grain Morphology**:** Effect of size, shape of sand an engineering properties. Effects of grain morphology, stress- strain behavior of soil.

Unit 3. Drainage & Dewatering : Purpose, various methods, well point systems, their suitability, flow towards slots from line source, concept of electro osmosis.

Unit 4. Consolidation**:** 2-D consolidation theory, application to consolidation due to sand drains, constructional features and design of sand drain installation. Secondary consolidation phenomenon & estimation of secondary consolidation settlement. Over consolidated soil, over consolidation ratio, Schmertmann's method for determination of Preconsolidation pressure field consolidation curve

Unit 5. Dynamic Soil Properties**:** Introduction, Representation of stress condition by Mohrs circle. Measurements of Dynamic soilproperties, stress-strain behavior of cyclically loaded soil.Strength of cyclically loaded soil.

Unit 6. Liquefaction**:** Introduction, phenomenon, evaluation, effects of Liquefaction.

TEXT BOOKS:

1. Arora K.R. : Soil Mechanics & Foundation Engineering
2. Punmia B. C. : Soil Mechanics & Foundation
3. Gopal Ranjan & Rao: Basic &Applied Soil Mechanics, New Age international Publisher, 2005
4. P Raj : Geotechnical Engineer, McGraw Hill Education,2000
5. VNS Murthy: Soil Mechanics & Foundation Engineering,Vol.-1, Saikripa Tech Consultant, Bangalore 1991
6. Purushottam Raj: Geotechnical Engg.
7. B. M. Das: Principle of Geotechnical Engg.
8. Winterkom H.F &Farg H.: Foundation Engineering Handbook
9. Geotechnical engineering , A practical problem solving Approch- Braja M.Das, N. Sivakugan, Cengage learning.
10. Principles of geotechnical Engineering- Braja M.Das, Cengage learning

CE404 (C) Construction Management (L-03) (Credits-3)

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

CO1	Define the fundamental principles of management theories
CO2	Understand the feasibility analysis in construction management and network analysis tools for cost and time estimation
CO3	Apply theoretical and practical aspects of construction management techniques to achieve project goals
CO4	Analyze contemporary construction management tools and methodologies in Indian context.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	--	--	--	--	--	--	--	--	--	--
CO2	2	2	--	1	--	1	--	--	1	--	--	--
CO3	3	3	--	1	--	1	--	--	1	--	--	--
CO4	3	2	--	1	--	1	--	--	1	--	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Introduction: Construction project, Unique features of construction, Project life cycle/ phases of a project, System approach to project management &Guidelines for project management system design. Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data. (07hrs)

Unit 2. Techniques of planning: Bar charts, Networks: basic terminology, types of precedence relationships: finish to start, start to start, finish to finish, start to finish, **Resource Scheduling-** line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling. (07hrs)

Unit 3. Network techniques for project management: Development of project network, preparation of CPM networks: Activity, Event, Activity and event times, Float: (Start, Finish, Total, Free and Independent), activity on link and activity on node representation, Critical path analysis, analysis of single relationship (finish to start) networks, computation of float values, critical and semicritical paths, calendering networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion. CPM and PERT model & Precedence network, Resource allocation, crashing and leveling, Computer applications in project management. (08 hrs)

Unit 4. Project implementation: Forms of project organization, Matrix organization, Project planning, Project control & Pre-requisite for successful project implementation.
Project cost management: Types of project cost (Direct and Indirect Cost), Cost duration curve, Basic principles for measuring project cash flows & Breakdown cost. (08 hrs)

Unit 5. Planning and organizing construction site and resources**:** Site: site layout, developing site organization, record keeping at site, Manpower: planning, organizing, staffing, motivation, Materials: concepts of planning, procurement and inventory control, Equipment: basic concepts of planning and organizing, Funds: cash flow, sources of funds.
Monitoring & control: Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. (8 hrs)

Unit 6. Project quality management: Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Quality control & Quality control charts. (07 hrs)

TERM WORK: (P-02)

1. Project network for the given activities with tabular calculation of floats.
2. Case study of a construction project involving the list of activities and location of critical path.
3. An exercise on compression and decompression of project network.
4. An exercise on plotting the cost- duration curves and measuring project cash flows.
5. Study of project management software packages.

TEXT BOOKS:

1. Barrie D.S. & Paulson B C, Professional Construction Management, McGraw Hill
2. Chitkara K K, Construction Project Management, Tata McGraw Hill
3. P K Joy, Handbook of Construction Management
4. King & Hudson, Construction Hazard and Safety Handbook, Butterworths
5. Antill J M &Woodhead R W, Critical Path Methods in Construction Practice, Wiley
6. Project Management by B.M. Naik, Vani Publishers,New Delhi.
7. Project Planning and Control with PERT and CPM by Dr. B. C. Punmia.

REFERENCE BOOKS:

1. 1 CPM and PERT by Srinath.
2. 2 Principles of Cost Management by Roy Pchery.

CE404 (D) HYDROPOWER ENGINEERING (L-03) (Credits-3)

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

CO1	Record the fundamentals of fluid mechanics, water resource engineering and environmental engineering
CO2	Understand the significance of water power and hydraulic structures related to water power engineering
CO3	Apply the knowledge of mathematics, statistics, fluid mechanics, in design of penstocks, surge tanks and intakes
CO4	Analyse and design complete unit of hydro electric power station & its components.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	--	--	--	--	--	--	--	--	--	--
CO2	--	1	--	--	1	--	--	--	1	--	2	--
CO3	3	--	1	--	--	1	--	--	--	--	--	--
CO4	1	--	--	2	--	2	--	--	1	--	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Introduction to Hydropower: Sources of energy, status of power, hydropower in India, importance of hydropower, hydropower in multipurpose reservoir system, estimation of water power potential, load curve, load factor capacity factor utilization factor, load duration curve, firm power, secondary power, prediction of load (07 hrs)

Unit 2. Hydroelectric Plants: Classification of hydel plants, run-of river plants, alley dam plants, historical development of pumped storage power plants, types of pump storage plant, advantages of pumped plants, two unit and three unit arrangement relative merits, reversible pump – Turbines, problems of operations topography, reservoirs and water conveyance, power house, efficiency of pumped storage plant, Small and micro hydropower.
Penstocks: Classifications of penstocks, Design criteria for penstocks, Economical diameter of penstocks, blocks, Conduit valves, Bends and manifolds, Water hammer, Resonance in penstock channel, surges, surge tanks. (07 hrs)

Unit 3. Intakes: Intakes, types of intakes, Losses in intakes, Air entrainment at intakes, Inlet aeration, Canals fore bay tunnels.
Turbines: Main types, Arrangements, Suitability and adaptability, Layouts (07 hrs)

Power Channels and Settling basins
Unit 4. Electrical and Mechanical Equipments: Generators, Excitation, Ventilation, Cooling and fabrication, transformers, Switchgear, Central room equipments, Mechanical equipment, transmission of electric power. (07 hrs)

Unit 5. Power House Planning: Surface power stations, Power house structure, Power house dimensions, Variations in design of power house, Underground (UG) power station, History, Location, Types of UG power house, Components of UG power house, Types of layout, Limitations of UG power house (07 hrs)

Unit 6. Tidal Power: Basic principle, Location of tidal power plant, Difficulties in tidal power generation, Components of tidal power plants, Modes of generation, Single and double basin system, Constructional aspects, Estimate of energy and power, Economic feasibility **(**07hrs)

TERM WORK:

1. Analytical solution for economical diameter of open stocks.
2. Hydraulic design of simple surge tanks.
3. Salient features of an existing H.P.P.
4. Study of Power house complex and components and arrangements.
5. Neat sketches of at least ten basic figures of the course.

TEXT BOOKS:

1. Water power engineering by Dandekar M.M. and Sharma K.N.
2. Water power engineering by Deshmukh

REFERENCE BOOKS:

1. Hydro power structures by Varhney R.S.
2. Hydroelectric engineering practice by Brown J.G.
3. Hydroelectric practice by Creager and Justin
4. Water power development (Vols. I, II and III) by E. Mosonyi
5. A Hand Book on hydrology by VenTe Chow

CE404 (E) – Remote Sensing and GIS (L-3) (Credits-3)

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

CO1	Recall the fundamentals of Surveying-I and Surveying-II
CO2	Understand fundamental knowledge of principles of electromagnetic radiation, ariel photography and remote sensing..
CO3	Apply knowledge of remote sensing and GIS in various fields of civil engineering
CO4	Relate skills and knowledge regarding basic principles of GIS

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	--	--	--	--	--	--	--	--	--
CO2	--	1	--	1	--	2	1	--	1	--	2	--
CO3	3	1	1	--	--	--	1	--	--	--	--	--
CO4	--	--	2	1	--	1	--	--	1	2	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Basics of Remote Sensing: Introduction. history & development, Definition and Scope of Remote Sensing, Advantages and disadvantages of remote sensing techniques, Type of Remote Sensing, Basic principle of remote sensing, Electromagnetic energy and its wavelength, Wavelength regions and their applications in remote sensing, Interaction of EMR with atmosphere, Atmospheric windows Ideal Remote sensing system. Radiometers. Spectral signature and Spectral response curves.

Unit 2. Remote Sensing Platforms and Sensors: Introduction, Terrestrial, Airborne and Space borne platforms-classification of satellites, Sunsynchronous and geostationary satellites, Type of Orbit. Satellite launch vehicles GSLV and PSLV, Sensors and Scanners, sensor material, sensor systems, Resolution of sensors, Swath, Image referencing system- Path and Row, Multispectral, Thermal and Radar Scanners,, Remote sensing data products, and their types: Analogue and Digital data formats, Thermal and Radar imageries, FCC, Indian remote sensing program. Various Earth resources satellites and their characteristics,

Unit 3. Aerial Photography: Introduction, Terminology. Geometry of vertical aerial photograph. Elements of photo and image interpretation, Interpretation key, Interpretation Instruments, Orientation of aerial photographs, Aerial mosaics, Flight planning, Types of aerial photographs. Scale of Aerial

photographs, Number of photographs to cover a given area, Relief displacement of vertical objects, Image Parallax and vertical exaggeration.

Unit 4. Digital Image Processing: Introduction, Image reduction, Image magnification, Image rectification and restoration, Image Enhancement contrast manipulation, spatial feature manipulation multi image manipulation. Image classification: supervised and unsupervised classifications, accuracy assessments and data merging

Unit 5. Geographical Information System: Introduction, Components of GIS- Hardware and Software components. data input and editing, spatial and non spatial data, raster and vector data, database management, data manipulation and analysis, dataoutput. **Global Positioning System:** Introduction to Global Positioning System (GPS) Fundamental concepts. GPS system elements and signals, Classification of GPS receivers.

Unit 6. Applications: Integrated Approach of RS and GIS Application: Application in Geological Investigations, Water Resources Management. Environmental studies, Land cover and Land use, Transportation planning, Application in Civil Engineering Projects — Dams and Bridges site investigations, Land slide studies. Flood studies.

TEXT BOOKS:

1. Remote Sensing Methods and Application by R. Michael Horti, Wiley Interscience Publications.
2. Introduction to Environmental Remote Sensing by Barett. E.C. and Curtis L.F., Chapman and Hall, London.
3. Remote sensing and Image Interpretation by Lillesand T.M. a

CE405- ELECTIVE – II (L-3) (Credits-3)

CE405 (A) Town And Country Planning – (L-3) (Credits-3)

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

CO1	Remember the fundamentals of Building Construction and Building Planning and Computer Aided Drawing
CO2	Understand various levels of planning, the elements involved in urban and regional planning and their interrelationships
CO3	Apply the various components of planning at neighbourhood, city, regional and national levels
CO4	Analyses spatial standards of facilities and prepare base maps for urban development.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	1	1	--	--	--	--	--	--	--	--	--
CO2	1	1	1	--	1	--	--	--	1	--	2	--
CO3	3	--	--	--	1	--	--	--	1	--	--	--
CO4	--	1	--	2	--	1	--	--	--	1	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Definitions and Rationales of Planning: Definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning - urbanization, industrialization and urban development; push and pull factors; migration trends and impacts on urban and rural development - rural-urban fringes - city region - area of influence and dominance (7 hrs)

Unit 2. Rural landscapes: regional planning: definition, need and importance, function, objective, concept of region, types of regions, delineation of regions - Types and contents of regional planning for block, district, state, nation, NCR, resource region, agro–climatic region, topographic region and sectoral planning, major regional problems and their solutions. (7 hrs)

Unit 3. Theories of urbanization: Concentric Zone Theory; Sector Theory; Multiple Nuclei Theory; Land Use and Land Value Theory of William Alonso; City as an organism: a physical entity, social entity and political entity –- Study of Urban Forms such as Garden City, Precincts, Neighbourhoods, - MARS Plan, LeCorbusier Concept, Radburn Concept (7 hrs).

Unit 4. Urban Structure and its Characteristics: Functions of Transportation Network - concept of accessibility and mobility, Transit Oriented Development (TOD) - Spatial
standards for residential, industrial, commercial and recreational areas, space standards for facility areas and utilities, Provisions of Town Planning Act, zoning, subdivision practice, metro region concept. (8 hrs)

Unit 5. Concept of New Towns: Meaning, role and functions: Special planning and development considerations, scope and limitations of new town development, Indian experience of planning and development of new towns. Urban Renewal: Meaning, significance, scope and limitations, urban renewal as a part of metropolitan plan. (8 hrs)

Unit 6. Town Development Plan: Scope, contents and preparation. A case study of development plan, scope, content and preparation of zonal development plans, plan implementation - organizational legal and financial aspects, public participation in plan formulation and implementation - Techniques of Preparation of Base Maps: Drawing size, scale, format, orientation, reduction and enlargement of base maps. (8 hrs)

TEXT BOOKS:

1. Hutchinson B.G., Principles of Transportation Systems Planning, McGraw-Hill, 1974
2. Khadiyali L.R. Traffic Engineering and Transport planning, Khanna Tech Publishers, 1999
3. Oppenheim N., Applied Models in Urban and Regional Analysis, Prentice-Hall, 1980
4. Rangwala, Town planning , Charotar publishing house, 28e, 2015.

References:

1. Eisner S, Gallion A and Eisner S., The Urban Pattern, Wiley, 1993.
2. Hiraskar G K, Fundamentals of Town planning, Dhanpat Rai publications, 1993.
3. N.K Gandhi – Study of Town and Country planning in India – Indian Town and Country planning Association, 1973.
4. Wilson, A.G, Urban and Regional Models in Geography and Planning, John Wiley and Sons, 1974.

CE405 (B) Traffic Engineering and Control – (L-3) (Credits-3)

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

CO1	Remember the fundamentals of Transportation Engineering I and II.
CO2	Understand the parking systems, riding quality standards, traffic safety and accident study and suggest the solutions to the practical problems.
CO3	Apply basic principles for the geometric design of roads and other traffic controlling devices.
CO4	Analysis of traffic using different methods.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	--	--	--	--	--	--	--	--	--
CO2	1	--	--	--	1	--	--	1	--	--	2	--
CO3	3	2	--	--	1	--	--	--	1	--	1	--
CO4	--	--	--	1	--	1	--	--	2	--	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1 . Elements of Traffic Engineering : Road, Road user & Road Vehicle Characteristics, problems related to heterogeneous traffic.
Traffic Surveys and Data collection : Speed, journey time and delay studies, methods of measurement of spot speed, headway, gaps, volume / capacity surveys, speed, volume-density interrelations, measurements of running and journey speeds, origin-Destination surveys, necessity, survey methods, sample size, data analysis & Presentation. Highway capacity, level of service concepts. (8 hrs)

Unit 2. Statistical methods : Binomial, Normal Poisson, Probability. distributions, Discrete and continuous, variable application to traffic flow, Test of significance – Chi-square & 'T' test, (Regression analysis) (8 hrs)

Unit 3. Traffic Design : Hierarchy of urban roads and their standards, Diverging, merging crossing weaving maneuver's conflict points, types of road junctions ,channelization of traffic flow, traffic rotary design, Grade separated inter-sections, Drive ways, design of pedestrian facilities, Design criteria for separate cycle track, Exclusive Bus lane, (Bus stop locations and facilities.) introduction to Intelligent Transport system (8 hrs)

Unit 4. Traffic Control Devices : Traffic signs, road markings, traffic signals, design of signalized intersections & signaling systems,(Queuing)Theory, Traffic control aids, and street furniture. Introduction to transport systems, Traffic controls for Expressway. (7 hrs)

Unit 5. Traffic Safety, Enforcement and Education :
Elements responsible for accidents, situations in India, Collection and interpretation of accident data and recording in Standard form, Analysis of Accidents. Traffic regulation and E`s of traffic management, (vulnerable road user safety, Introduction to Regulation Act.)
Motor Vehicle Acts and Rules, traffic Education, traffic Controls on National Highways (7 hrs)

Unit 6. Urban Traffic: Present traffic scenario. Urban transportation problems, mixed traffic flow, head and administrative set up of traffic cells at various levels, co-ordination with other transport modes. **Parking :** Parking surveys, on and off street parking, parking systems, parking demand, design of off street parking lot, underground & multistoried parking.(Truck lay bye, bus lay bye, facilities to parking and way side amenities. (7 hrs)

CE405 (C) - OPEN CHANNEL HYDRAULICS (L-3) (Credits-3)

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

CO1	Record the fundamentals of fluid mechanics, water resource engineering.
CO2	Understand the concepts related to various types of flow energy and momentum principles.
CO3	Apply the knowledge of theories and equations of open channel flow in analyzing and designing the open channel network systems.
CO4	Analyse the different types of flow using various governing equations.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	1	1	--	--	--	--	--	--	--	--	--
CO2	--	1	--	--	1	--	--	--	1	--	2	--
CO3	3	--	--	2	--	--	--	1	--	1	--	--
CO4	--	--	--	2	--	1	--	--	2	--	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Basic Principles: Open channel flow and its classification, Comparison between open channel flow and pipe flow, energy and momentum principles,critical flow and its computations, transitions geometrical parameters of a channel, Velocity Distribution of channel section (07 hrs)

Unit 2. Uniform Flow: Computation of uniform flow, design of channels for uniform flow (Nonerodible, erodible and grassed channels) concept of boundary layer, surface roughness, and velocity distribution of instability of uniform flow. Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy‟s formula, Manning's formula. Factors affecting Manning's Roughness Coefficient .Most economical section of channel. Computation of Uniform flow, Normal depth. (07 hrs)

Unit 3. Gradually Varied Flow: Theory and analysis, methods of computations, flow profiles in nonprismatic channels, spatially varied flow. Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and direct integration method.

(07 hrs)

Unit 4. Rapidly Varied Flow: Flow over spillway, hydraulic jump and its use in energy Dissipation. Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types ,applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow-Momentum principle, applications: Force on plates, pipe bends, and moments of momentum equation. (07 hrs)

Unit 5. Unsteady Flow: Equation of continuity and equation of motion, waves and their classification, celerity of wave, surges.
Sediment Transport: Introduction, basic theories of sediment transportation, dunes and Ripples, scour criteria

(07 hrs)

Unit 6. Open Channel and River Models: Principles and interpretations of results
Computational Fluid Dynamics: Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D. (07 hrs)

TERM WORK: (P-2)

1. Venturi Flume
2. Standing Wave Flume
3. Gradually Varied Flow
4. Hydraulic Jump
5. Flow under Sluice Gate
6. Studies in Wind Tunnel
7. Experiments on transitions
8. Computation of α and β for various channel.
9. Term Work shall be consisting of at least 4 problems on each of the listed above.
10. Computation of GVF using computer programs.

TEXT BOOKS:

1. Open Channel Hydraulics by Ven Te Chow (McGraw Hill Pub. 1959)
2. Flow in open Channel by K. Subramanya ((McGraw Hill Pub. 1986.)
3. Open Channel Hydraulics by Strum.
4. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House.

REFERENCES

1. Fluid Mechanics, A.K. Jain, Khanna Publishers.
2. Fluid Mechanics and Fluid Pressure Engineering, S.S. Kumar, F.K. Kothari & Sons.

CE405 (D) - Water Conservation & Management (L-3) (Credits-3)

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

CO1	Recall the concepts of WRE-I and II.
CO2	Understand the concepts related to Soil and water conservation techniques and watershed management
CO3	Apply the knowledge of theories and equations to drainage design, irrigation system management etc.
CO4	Analyse the different practice for soil and water conservation.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	--	--	--	1	--	--	--	--	--
CO2	1	1	--	--	2	--	--	1	1	--	2	--
CO3	3	--	--	--	1	--	1	1	--	2	--	--
CO4	--	--	--	2	--	1	--	--	2	1	--	1

1: Slightly 2: Moderately 3: Substantially

Unit 1: Soil Erosion & Its Control: Basic concepts of soil erosion ; Factors affecting soil erosion; Types of erosion: Water erosion, Wind erosion, Gully erosion and Stream bank erosion; Mechanics of soil erosion; Models for estimating soil erosion losses (USLE); Soil erosion control structures and their design: Contour bunding, Graded bunding, Bench terracing and Contour trenching. (09 Hrs)

Unit 2: Soil & Water Conservation: Need of soil and water conservation; Water harvesting techniques: Farm Ponds & Percolation Tanks: Selection of site, Survey & Design; Design and construction of Cement Nalla Bandhara (CNB) structures. (08Hrs)

Unit 3: Hydrology of Watershed: Hydrological processes in watershed; Numerical modeling of hydrologic processes in watershed; Estimation of peak design runoff rate: (Rational method and Curve number method). (06Hrs)

Unit 4: Watershed Development & Management: Watershed development: Ridge to Valley Concept; Morphological analysis of watershed; Land use capability classification. (06Hrs)

Unit 5: Irrigation System Management: Components of irrigation system; Irrigation system management; Participative irrigation management. (05 Hrs)

Unit 6: Land Grading & Drainage: Land grading survey and design: (Plane and Profile methods); Drainage design criteria & drainage equations; Design of surface and subsurface drainage systems. (06 Hrs)

TEXT BOOKS:

1. Frevert, R.K., Schwab, G.O. Edminster, T.W. and Barnes, K.K. 2009, Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
2. Michael, A.M., 2007, Irrigation Theory & Practice Engineering. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Murthy, V.V.N., 2002, Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
5. Suresh, R., 2004, Soil and Water Conservation Engineering, Standard Publishers, New Delhi.

CE405 (E) – Operational Research (L-3) (Credits-3)

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

CO1	To recall fundamentals of Construction Management and professional Practice.
CO2	Understand merits and demerits of various models of operational research.
CO3	Apply basic knowledge of various operation research models for a particular rela life problem.
CO4	Analyse the performance of various operation research models.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	1	1	--	--	--	--	--	--	--	--	--
CO2	1	--	--	1	--	1	--	--	1	--	2	--
CO3	3	1	--	--	1	--	1	--	--	1	--	--
CO4	--	1	--	--	--	1	1	--	1	--	--	--

1: Slightly 2: Moderately 3: Substantially

Unit 1. Introduction to O. R. & basic O.R. Models, Characteristics, phases & Methodology of O.R., Limitations & Applications. Linear Programming: Introduction, Linear programming problem formulation, LPP Solution by Graphical Method, Simplex Method, Principle of Duality & Formulation of Model only, Sensitivity Analysis Concept Only.

Unit 2. Transportation Model: Introduction, Formulation, Optimal Solution by MODI method, Unbalanced Transportation Problem, Degeneracy, Transshipment Problem. Assignment Model – Introduction, Variants of Assignment Problems. Traveling Salesman Problem – Branch & Bound Technique.

Unit 3. Game Theory: Introduction, Minimax and Maximin, Criteria and Optimal Strategy, Solution of games with Saddle Points, Games without Saddle Points, 2x2 games, Dominance Principle, mx2 & 2xn games. (No Graphical Method). Sequencing Model – Introduction, Sequencing Model: n job two machines problem, n job 3 machines problem, 2 jobs m machine problem. Inventory Model: Inventory control costs, analysis of inventory models with deterministic demand (Single Product), ABC analysis.

Unit 4. Network Model: Project Management, Formation of Network, CPM & PERT analysis, Probability of Completion of Project, Cost Analysis of Project, and Concept of Crashing. .

Unit 5. Replacement Model: Replacement Analysis – Replacement of items that deteriorated with time, Replacement of items that fails suddenly, Group Replacement.

Unit 6. Queuing Theory, M/M/1 model (without derivation). Simulations – Concept, applications in waiting line situations, inventory and network.

TEXT BOOKS:

1. Operation Research, D.S. Hira & P. Gupta, S. Chand Publications.
2. Operation Research, J. K. Sharma, Macmilan Publishers.
3. Operation Research, H. Taha, Dorling Kindersley.
4. Operation Research, R. D. Askhedkar & R.V. Kulkarni, Dhanpat Rai & Sons

CE406– Seminar (Credits-1)

There is no specific syllabus for this course. However, student can choose any topic, of his choice, pertaining to Engineering Structures. Topic should be a relevant and currently researched one. Students are advised to refer articles published in current journals in the area of Civil Engineering for choosing their seminar topics. Student should review minimum of 5 to 6 research. Papers relevant to the topic chosen, in addition to standard textbooks, codeb ooks, etc. Students are required to prepare a seminar report, in the standard format and give presentation to the Seminar Assessment Committee (SAC) in the presence of their classmates. It is mandatory for all the students to attend the presentations of their classmates.

CO1	Identify and chose appropriate topic of relevance.
CO2	Assimilate literature on technical articles of specified topic and develop Comprehension.
CO3	Write technical report.
CO4	Design and develop presentation on a given technical topic.
CO5	Deliver technical presentation on a specified topic.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	2	2	3	2	2	1
CO2	2	2	1	3	2	2	3	2	2	1	1	2
CO3	1	1	3	3	2	1	1	1	1	2	2	2
CO4	2	3	2	3	3	1	2	2	3	1	2	1
CO5	1	2	2	1	2	3	3	1	2	1	2	1

1: Slightly 2: Moderately 3: Substantially

SEMESTER - VIII

CE407– Project (Industry/In-house) (Credits-16)

CO1	Understand the basic concepts & broad principles of civil engineering projects
CO2	Apply the theoretical concepts to solve civil engineering problems with teamwork and multidisciplinary approach
CO3	Analyse theoretical /experimental/model based/ case study for any given civil engineering real life problem need to solve using basic knowledge of civil engineering subjects
CO4	Enable the students to implement project planning in their project work
CO5	Demonstrate professionalism with ethics; present effective communication and writing skills and relate engineering issues to broader societal context

Mapping of course outcomes with programme outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	3	2	2	1	2	1
CO2	2	2	3	3	2	3	3	2	2	1	1	2
CO3	3	3	3	3	3	3	3	2	2	2	2	1
CO4	2	2	2	3	3	2	2	2	2	1	2	1
CO5	2	2	3	3	3	3	3	2	3	3	2	2

1: Slightly 2: Moderately 3: Substantially