IV – I

IRRIGATION AND HYDRAULIC STRUCTURES

(Professional Elective – III)

	L	T	P	C
Subject Code: UGCE7T0120				
IV Year / I Semester	3	-	-	3

Prerequisite: Basic knowledge of Engineering mathematics, Water resources Engineering, Fluid Mechanics and structural design.

COURSE OBJECTIVES: The course is designed to –

1. Introduce the types of irrigation systems
2. Introduce the concepts of planning and design of irrigation systems
3. Discuss the relationships between soil, water and plant and their significance in planning an irrigation system
4. Understand design methods of erodible and non-erodible canals
5. Know the principles of design of hydraulic structures on permeable foundations
6. Know the concepts for analysis and design principles of storage and diversion head works
7. Learn design principles of canal structures

SYLLABUS

UNIT –I

IRRIGATION: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation. **7hrs**

UNIT-II

CANALS: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting. **6hrs**

CANAL STRUCTURES:

FALLS: Types and location, design principles of Sarada type fall and straight glacis fall. REGULATORS: Head and cross regulators, design principles **13hrs**

CROSS DRAINAGE WORKS: Types, selection, design principles of aqueduct, siphon aqueduct and super passage.

OUTLETS: types, proportionality, sensitivity and flexibility

UNIT-III

DIVERSION HEAD WORKS: Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient. **8hrs**

UNIT-IV

RESERVOIR PLANNING: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation. **6hrs**

DAMS: Types of dams, selection of type of dam, selection of site for a dam.

UNIT-V

GRAVITY DAMS: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis, drainage galleries grouting. **7hrs**

UNIT – VI

EARTH DAMS: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters, stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions. **5hrs**

SPILLWAYS: Types, design principles of Ogee spillways, types of spillways crest gates. Energy dissipation below spillways-stilling basin and its appurtenances.

COURSE OUTCOMES: At the end of the course, the students are expected to

CO1: Estimate irrigation water requirements

CO2: Design irrigation canals and canal network

CO3: Plan an irrigation system

CO4: Design irrigation canal structures

CO5: Plan and design diversion head works

CO6: Analyze stability of gravity and earth dams

CO7: design ogee spillways and energy dissipation works

Mapping of COs to PO

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	2	-	-	-	-	-	3	3
CO2	3	3	3	3	-	2	2	-	-	-	-	-	3	3
CO3	3	3	3	3	-	2	2	-	-	-	-	-	3	3
CO4	3	3	-	3	-	-	-	-	-	-	-	-	-	3
CO5	3	3	3	3	-	2	2	-	-	-	-	-	3	-
CO6	3	3	-	3	-	-	-	-	-	-	-	-	-	3
CO7	3	3	3	3	-	2	2	-	-	-	-	-	3	-

TEXT BOOKS:

1. 'Irrigation and Water Power Engineering'by Punmia B C,P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi
2. 'Irrigation and Water Resources Engineering'by Asawa G L (2013), New Age International Publishers.
3. 'Irrigation Water Resources and Water Power Engineering'by Modi P N (2011), Standard Book House, New Delhi.
4. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Khanna Publishers.

REFERENCES:

1. 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
2. 'Irrigation Engineering' by Sharma R.K. and Sharma, T.K (2012), S.Chand & Co Publishers.
3. 'Water Resources Engineering' by Satyanarayana Murthy Challa (2008), New Age International Publishers

WASTE WATER TREATMENT & WATER RESOURCE MANAGEMENT

(Professional Elective – III)

Subject Code: UGCE7T0222	L T P C
IV Year / I Semester	3 - - 3

Prerequisites: Waste water Treatment, Water Resources Engineering, Fluid Mechanics, Basic knowledge on Engineering mathematics, Hydrology (Unit of water resources Engineering)

COURSE OBJECTIVES:

1. Approach to safe drinking water, wastewater and its treatment.
2. To know the working & design aspects of every units in water & Wastewater treatment plant.
3. To familiarize the students with principles, design and operation of various conventional and advanced processes for treatment of water and wastewater.
4. To manage water resources in efficient way.

SYLLABUS:

UNIT –I

Introduction: Biological Wastewater Treatment, Biological Sludge Treatment. Biological Systems: Fundamentals of Microbiology and Biochemistry, Bioenergetics and Metabolism, Kinetics of Biological Growth. **8 hrs**

UNIT-II

PROCESS ANALYSIS: Reaction Rates, Effect of Temperature on Reaction Rate, Enzyme Reaction and Kinetics, Effect of Temperature on Reaction Rate, Reactor Analysis, Residence Time Distribution **8 hrs**

UNIT-III

SEWERAGE SYSTEM: Domestic wastewater characteristics, Flow equalization, population equivalent, Treatment flow chart. Primary, secondary and tertiary treatment of domestic wastewater. **8hrs**

UNIT-IV

ACTIVATED SLUDGE PROCESS: Nitrogen Removal- Biological nitrification and Denitrification. ASP design for nutrient removal, Process operation: (F/M), mean cell residence time, oxygen requirement. Biological and Chemical phosphorus removal, Sedimentation of Activated Sludge. Sequencing Batch Reactor, Oxidation Ditch and membrane bioreactors **10hrs**

BIOFILM PROCESS: Trickling Filter, Biotower, Rotational Biological Contactor, Integrated Activated Sludge and Biofilm processes.

UNIT – V:

WATER RESOURCES ECONOMICS: Basics of engineering economics, economic analysis, Conditions of project optimality, Benefit and cost analysis. Application of simulation techniques in water resources, Planning of reservoir system, Optimal operation of single reservoir system, Allocation of water resources, Optimal cropping pattern, Conjunctive use of surface and sub-surface water resources **10hrs**

COURSE OUTCOMES: At the end of the course the student will be able to

1. Explain the fundamentals of Microbiology and Biochemistry
2. Analyze the reaction rates associated with the temperature.
3. Outline the characteristics of waste water.
4. Categorize various treatment methods of waste water.
5. Identify various methods of managing water resources.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	3	2	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	3	2	2	-	-	-	-	-	2	3	2
CO4	3	3	2	3	3	-	-	-	-	-	2	2	3	2
CO5	3	3	2	3	3	2	-	-	-	-	-	2	3	2

TEXT BOOKS:

1. 'Water Resources System Analysis' by Vedula S and P P Mujumdar, McGraw Hill Company Ltd, 2005.
2. 'Water Resources Economics' by James D and R. Lee, Oxford Publishers, 2005.
3. Metcalf and Eddy, "Wastewater Engineering", 4th Ed., McGraw Hill.
4. R.L. Droste, "Theory and Practice of Water and Wastewater Treatment", John Wiley.
5. S.R. Qasim, "Wastewater Treatment Plants – Planning, Design and Operation", CRC Press, Florida.

REFERENCES:

1. Water and waste water technology by Mark J Hammer and Mark.j Hammer Jr, 2007, Sixth Edition, PHI
2. Waste Water treatment-concepts and design approach by G,L. Karia and R.A. Christian, PHI
3. Waste Water engineering by Met Calf and Eddy,1979, 5/e McGraw-Hill
4. Theory and practice of water and wastewater water treatment by Ronald L Drost, Second Edition 2018 Wiley India publishers

ADVANCED STRUCTURAL ANALYSIS

(Professional Elective – III)

Subject Code: UGCE7T0320	L T P C
IV Year / I Semester	3 - - 3

Prerequisites: The student should have knowledge in mathematics, physics and Structural Engineering.

COURSE OBJECTIVES: The course is designed to -

1. Introduce the theory of elasticity and differential equations for plane stress and plane strain.
2. Provide an overview of the concept of analysis of two dimensional problems in structural dynamics.
3. Understand the concept of free vibrations, forced vibrations and their analysis with respective to civil engineering.

SYLLABUS

UNIT-I

INTRODUCTION TO THEORY OF ELASTICITY**:** notation for forces and stress , components of stress, components of strain , Hooke's law.

8hrs

UNIT-II

PLANE STRESS AND STRAIN: Definitions, differential equation of equilibrium, boundary conditions and compatibility equations.

10hrs

UNIT-III

TWO DIMENSIONAL PROBLEMS IN RECTANGULAR CO-ORDINATES : Airy stress function, solution by polynomials, saint venant principle, solution of bi-harmonic equation using Fourier series. **10hrs**

UNIT-IV

INTRODUCTION TO STRUCTURAL DYNAMICS: Dynamic loadings, formulation of equation of motion - Newton's second law of motion. D'Alember't s principle. Solution of undamped single degree of freedom of system.

8hrs

UNIT-

FREE VIBRATIONS: Damped single degree of freedom system, Viscous damping, equation of motion, critically damped, over damped and under damped system, Logarithmic decrement.

10hrs

UNIT-VI **10hrs**

FORCED VIBRATIONS: Response of one degree of freedom system to

harmonic loading: undamped harmonic excitation, damped harmonic excitation, evaluation of damping at response, response to support motion.

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

CO1: Apply principles of elasticity to determine stresses and strains

CO2: Make use of elasticity theory and formulate plane stress and plane strain

CO3: Explain the solutions for two dimensional structural systems

CO4: Construct the necessary equations for dynamic loadings

CO5: Analyze single degree of freedom systems of free & forced vibrations with and without damping

Mapping of COs to POs

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Mechanics of solids by Arbind Kumar Singh, Prentice-Hall of India, New Delhi.
2. Theory of Elasticity by Timoshenko and Goodier, McGraw Hill Book Company, New
3. Structural Dynamics by Mario Paz, CBS Publishers, New Delhi.

REFERENCES:

1. Theory of Elasticity by Sadhu Singh, Khanna Publishers.
2. Dynamics of structures by A. K. Chopra, Prentice Hall of India.

INDUSTRIAL AND WASTE WATER MANAGEMENT

(Professional Elective – III)

	L	T	P	C
Subject Code: UGCE7T0422				
IV Year / I Semester	3	-	-	3

Prerequisites: Environmental Engineering

COURSE OBJECTIVES:

1. To learn about various treatment methods of waste water
2. To impart knowledge on Effluent disposal methods
3. To know about manufacturing process of different industries

SYLLABUS:

UNIT I **6hrs**

INDUSTRIAL WATER QUANTITY AND QUALITY REQUIREMENTS: Boiler and cooling waters, Process water for Textiles, Food processing Brewery Industries, power plants fertilizers, sugar mills.

UNIT II **8hrs**

MISCELLANEOUS TREATMENT: Use of Municipal wastewater in Industries Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange Ultra filtration, Freezing, elutriation Removal of Iron and Manganese, Removal of Colour and Odour

UNIT III **8hrs**

BASIC THEORIES OF INDUSTRIAL WASTEWATER MANAGEMENT: Industrial waste survey - Measurement of industrial wastewater Flow generation rates – Industrial wastewater sampling and preservation of samples for analysis Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes.

UNIT IV **8hrs**

INDUSTRIAL WASTEWATER DISPOSAL MANAGEMENT: Discharges into Streams, Lakes and oceans and associated problems,Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes ,Effluent Disposal Method.

UNIT V **8hrs**

PROCESS AND TREATMENT OF SPECIFIC INDUSTRIES-1: Manufacturing Process and origin, characteristics effects and treatment methods of liquid waste from Steel plants, Fertilizers Textiles, Paper and Pulp industries, Oil Refineries Coal and Gas based Power Plants.

PROCESS AND TREATMENT OF SPECIFIC INDUSTRIES-2: Manufacturing Process and

origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Pharmaceutical Plan.

COURSE OUTCOMES: Upon the successful completion of this course, the students will be able to:

1. Explain about the industrial water quantity and various industries.
2. Classify the advanced water treatment methods.
3. Summarize the industrial waste survey by sampling of industrial wastes.
4. List out the various industrial waste water disposal methods.
5. Illustrate the industrial waste water treatment methods from various industries.

Mapping of COs to PO

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2		-	-	2	-	-	3	-
CO2	-	2	-	-	-	-	2	-	-	-	-	-	3	-
CO3	-	-	2	3	-	3	3	-	-	-	-	-	-	-
CO4	-	-	2	2	-	2	2	-	-	-	-	-	2	-
CO5	-	2	2	-	-	2	-		-	-	-	3	3	-

TEXT BOOKS:

1. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH,New Delhi.
2. Industrial Wastewater Treatment by KVSG Murali Krishna.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning,Delhi.
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. JArceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rdEdition.

REFERENCES:

1. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc-GrawHill, Third Edition
2. Wastewater Engineering by Metcalf and Eddy Inc., Tata Mc.Grawhill Co., New Delhi
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.

URBAN TRANSPORTATION PLANNING

(Professional Elective – III)

Subject Code: UGCE7T0520 L T P C
IV Year / I Semester 3 - - 3

Prerequisites: The student should have knowledge in Transportation Engineering.

COURSE OBJECTIVES: The course is designed to -
1. Study various procedures for travel demand estimation.
2. Understand various data collection techniques for OD data.
3. Study various models and techniques for trip generation, trip distribution, mode choice and traffic assignment.
4. Develop alternative urban transport network plans.

SYLLABUS:

UNIT –I

URBAN TRANSPORTATION PROBLEMS & TRAVEL DEMAND: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques **10hrs**

UNIT –II

DATA COLLECTION AND INVENTORIES: Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship. **8hrs**

UNIT –III

TRIP GENERATION & DISTRIBUTION: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models **5hrs**

UNIT –IV **6hrs**

MODE CHOICE ANALYSIS: Mode Choice Behavior, Competing Modes,

Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation

UNIT –V

TRAFFIC ASSIGNMENT: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. **6hrs**

UNIT –VI

CORRIDOR IDENTIFICATION, PLAN PREPARATION & EVALUATION: Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies **8hrs**

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

CO1: Estimate Travel Demand for an Urban Area

CO2: Design Urban Transportation Network

CO3: Make use of Mode Choice Behavior and Mode Split Models

CO4: Apply the Shortest Path Models for Route Assignment

CO5: Identify the corridor and plan for providing good transportation facilities.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3		3	2	-	2	-	-	-	2	-	-	-
CO2	3	-	-	-	2	-	2	-	-	-	-	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	-	-
CO4	3	3	-	2	-	2	2	-	-	-	-	-	-	-
CO5	3	2	-	2	-	2	3	-	-	-	-	3	-	-

TEXT BOOKS:

1. 'Introduction to Urban System Planning' by Hutchinson, B.G.,McGraw Hill.
2. ''Traffic Engineering and Transportation Planning' by Kadiyali.L.R., Khanna Publishers, New Delhi

REFERENCES:

1. 'Urban Transportation Planning: A decision oriented Approach' by Mayer M and Miller E, McGraw Hill.

BRIDGE ENGINEERING

(Professional Elective - IV)

Subject Code: UGCE7T0620	L T P C
IV Year / I Semester	3 - - 3

Prerequisites:

The student should have knowledge in design of Reinforced concrete structures and basics of mathematics.

COURSE OBJECTIVES:

1. Familiarize Students with different types of Bridges and IRC standards.
2. Equip student with concepts and design of Slab Bridges, T Beam Bridges, and Box Culverts.
3. Understand concepts of design of Plate Girder Bridges.
4. Familiarize with different methods of inspection of bridges and maintenance.

SYLLABUS:

UNIT I

Introduction: Bridges- Types- Slab bridges, T Beam, Arch bridges, Cable Stayed bridges, prestressed concrete bridges, Truss Bridges, Culverts, Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections, Linear waterway, types of foundations- Open, Pile, Well Foundations, Bearings – Types, Introduction to Loading standards- Railway and IRC Loading. **9 hrs**

UNIT II

Slab Bridges:

Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length, Design of interior panel of slab Guyon's method, Massonet Method, Hendry- Jaegar Methods, Courbon's theory, Pigeaud's method.

11 hrs

UNIT-III

T-Beam bridges: Introduction, Analysis and design of various elements of bridge, Design of deck slab, Longitudinal girders, Secondary beams- Reinforcement detailing. **10 hrs**

UNIT-IV

Plate Girder Bridges: Elements of plate girder, design-web- flange-intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing.

10 hrs

UNIT-V

Box Culverts: Loading, Analysis and Design- Reinforcement detailing. **10 hrs**

UNIT-VI

Inspection and maintenance of bridges: Procedures and methods for inspection, testing of bridges, Maintenance of substructure and superstructures, Maintance of bearings – maintenance of Schedules. **7 hrs**

COURSE OUTCOMES:

Upon the successful completion of this course, the students will be able to:

CO1: Explain different types of bridges with main components and IRC standard live load diagrams.

CO2: Solve the RCC slab bridges with different loading and reinforcement detailings

CO3: Design of T- beam bridges along with structural drawing

CO4: Design of plate girder bridges along with structural drawing

CO5: Solve the box culverts for the given loading and detailing structural Drawings

CO6: Examine the Inspection and Maintenance of Bridges to prepare reports.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	3	-	-	-	2	-	-	-	-	-	-
CO3	2	3	3	3	-	-	-	2	-	-		-	-	-
CO4	2	3	3	3	-	-	-	2	-	-	-	-	-	-
CO5	2	3	3	3	-	-	-	2	-	-	-	-	-	-
CO6	3	2	-	2	3	-	-	-	2	2	-	2	-	-

TEXT BOOKS:

1. 'Design of Bridge engineering' by N.Krishnam raju.
2. 'Essentials of bridge engineering' by Jhonson victor D
3. 'Design of bridge structures' by T.R.Jagdeesh, M.A. jayaram, PHI

REFERENCES:

1. 'Design of Concrete Bridges' by Aswini, Vazirani, Ratwani.
2. 'Design of Steel Structures' by B. C. Punmai, Jain & Jain, Lakshmi Publications
3. IRC Codes relevant to design.
4. IRC-24-2001-Standard Specifications-code of practice for road bridges.
5. IRC-12-2011-Code of practice for Concrete Road Bridge.
6. IRC-5-2015- Standard Specifications-code of practice for road bridges, Section 1 – General features of Design.
7. IRC-6-2014- Standard Specifications-code of practice for road bridges. Section-II

STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

(Professional Elective – IV)

Subject Code: UGCE7T0720	L	T	P	C
IV Year /I Semester	3	-	-	3

Prerequisites: The student should have knowledge in mathematics, physics and structural Engineering.

COURSE OBJECTIVES: The course is designed

1. To prepare the student to understand the fundamentals of vibrations of various physical models for single and multi-degree freedom systems vibrations..
2. Understand the concept of earthquake resistant and codal provisions to design the structures as earthquake resistant
3. Explain the importance of seismic retrofitting strategies.

SYLLABUS

UNIT I

INTRODUCTION: Simple harmonic motion, terminology, Newton's Law, D'Alembert's Prinicple, Resonance, Introduction to mechanism of damping. Damped and Undamped oscillations. Degrees of freedom. Various mechanisms of damping. Equivalent viscous damping. **8hrs**

UNIT II

SINGLE DEGREE OF FREEDOM SYSTEMS: Free vibrations, free damped vibrations, forced vibrations with and without damping. Support excitation and vibration measuring instruments. Amplitude and Phase response diagrams. **8hrs**

UNIT III

MULTI DEGREE OF FREEDOM SYSTEMS: Two / Three degree of freedom systems, static and dynamic coupling, vibration absorbers, Principal coordinates, Principal modes, Orthogonality conditions Hamilton's Principle, Lagrange's equation and application. Longitudinal vibration, lateral vibration, tensional vibration of shafts, dynamical equations of equilibrium of elastic bodies, natural frequencies and mode shapes determination. **10hrs**

UNIT IV

Elements of Earthquake Engineering: Earthquake magnitude and intensity, Focus and Epicentre, Causes and Effects of Earthquakes, Characteristics of Earthquake, Seismic zone mapping. **6hrs**

UNIT V

Seismic Resistant Design: Concept of Seismic resistant design, reduction factors - Over strength, Ductility and Redundancy -Determination of earthquake forces on structures, Basic principles of Earthquake resistance ,Concepts of earthquake resistant construction. Base isolation and energy and dissipation devices. **10hrs**

UNIT VI

Seismic retrofitting: Repair, rehabilitation and retrofitting, retrofitting strategies - Importance of reanalysis .Case Studies. **8hrs**

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

CO1: Explain the fundamental theory of dynamic equations of motion
CO2: Analyze single degree of freedom systems without damping and with damping
CO3: Analyze multi degree freedom system and continuous systems using iterative techniques
CO4: Explain the elements of earthquake engineering
CO5: Develop the concept of seismic resistant design and base isolation
CO6: Discuss the importance of seismic retrofitting

Mapping of COs to POs

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO6	3	3	2	3	-	-	-	-	-	-	-	3	-	-

TEXT BOOKS:

1. Mechanical Vibrations by Singiresure.S.Rao, Pearson EducationLPE-2004.
2. Rao, J.S and Gupta .K., Theory and practice of Mechanical vibrations,Wiley Eastern Ltd., New Delhi,2002.
3. A.K. Chopra, Dynamics of Structures, Theory and Applications to Earthquake Engineering, Pearson Education, 2004.
4. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, 2006.
5. D.S. PrakashRao, Design Principles and Detailing of Concrete Structures, Tata McGraw-Hill Publishing Company, 1995.
6. “Elements of Earth quake engineering “ by Jai Krishna and B.Chandra, South Asia Publishers, New Delhi.

REFERENCES:

1. Fug, Y.C., An Introduction to Theory of Aeroelasticity, John Wiley &Sons, NewYork,1984
2. Timoshenko, S., Vibration Problems in Engineering, John Wiley and Sons, New York, 1987.
3. Shock and Vibrations by Harris & Creed Mc-Graw Hill book company, third edition.
4. Mechanical Vibrations by S.Grahamkelly- TMH 2004edition.
5. Mechanical Vibrations G.K.Groover, Nemchand and Brothers 2001edition.
6. Vibrations and waves CBS Publishers and Distributors MIT series1987.
7. S.L. Kramer, Geotechnical Earthquake Engineering, Pearson Education, 2004.
8. Mario Paz, International Handbook of Earthquake Engineering: Codes, Programs, and Examples, Springer Verlag, 1995.
9. IS: 13920 for Ductility detailings

ADVANCED FOUNDATION ENGINEERING

(Professional Elective – IV)

Subject Code: UGCE7T0820 L T P C

IV Year / I Semester 3 0 0 3

Prerequisite: Knowledge of mathematics and geotechnical engineering

COURSE OBJECTIVES:

1. Identify the safe bearing capacity of footings subjected to vertical and inclined loads
2. Develop the knowledge on advanced methods of settlement computations and proportion foundation
3. Appraise the methods of computing the pull- out capacity and negative skin friction of piles and compute the settlements of pile groups in clays
4. Estimate the problems posed by expansive soils and the different foundation practices devised
5. Distinguish the difference between isolated footings and combined footings and mat foundations
6. Develop the concept of designing reinforced earth.

SYLLABUS

UNIT I **[7hrs]**

BEARING CAPACITY OF FOUNDATIONS: Bearing capacity of Foundations using general bearing capacity equation Meyerhof's, Brinch Hansen's and Vesic's & Skempton's Method

UNIT II **[7hrs]**

SETTLEMENT ANALYSIS: Immediate settlement of footings resting on granular soils. Schmertmann & Hartman method – De Beer and Martens method, Immediate settlement in clays – Janbu's method, Correction for consolidation settlement using Skempton and Bjerrum's method – Correction for construction period

UNIT III **[9hrs]**

DESIGN OF SHALLOW FOUNDATION: Purpose and types of isolated and combined footings — Mats/ Rafts – Proportioning of footings – Ultimate bearing capacity of mat foundations, Allowable bearing capacity of mats founded in clays and granular soils – compensated rafts

UNIT IV **[8hrs]**

EARTH-RETAINING STRUCTURES: cantilever sheet piles – anchored bulkheads, fixed and free earth support methods – design of anchors, — braced excavations – function of different components – forces in ties – stability against bottom heave

UNIT V **[11hrs]**

PILE FOUNDATIONS: single pile versus group of piles -— load-carrying capacity of pile groups – negative skin friction (NSF) settlement of pile groups in sands and clays – laterally loaded piles in granular soils, Reese and Matlock method – laterally loaded piles in cohesive soils – Davisson and Gill method – Broms' analysis.

UNIT VI **[10 hrs]**

FOUNDATIONS IN EXPANSIVE SOILS: Definitions of swell potential and swelling pressure – determination of free swell index, factors affecting swell potential and swelling pressure – foundation practices, sand cushion method – CNS layer - drilled piers and belled piers – under-reamed piles moisture control methods

COURSE OUTCOMES

1. Compute the bearing capacity of foundations on cohesive & cohesion less soil.
2. Design the shallow foundations adopting depth and location, bearing capacity and settlement criteria
3. Adapt the type of construction and stability analysis regarding earth retaining structures
4. Analyze the action of a single pile and group piles considering the settlement
5. Analyze the action of piles under lateral loading
6. Identify and solve the problems associated with expansive soil in construction

CO PO Mapping

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	2	-	-	-	-	-	2
CO3	2	2	-	2	-	-	-	-	-	-	-	2	-	2
CO4	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	2	-	2	-	-	2	2	-	-	-	-	-	-	-

TEXT BOOKS:

1. 'Basic and applied soil mechanics' by Gopal Ranjan and ASR Rao, New Age Publishers.
2. 'Soil Mechanics and Foundation Engineering' by VNS Murthy, CBS Publishers.
3. 'Principles of Foundation Engineering' by BM Das, Thomson Brooks/Cole.

REFERENCES:

1. 'Foundation Analysis and Design' by JE Bowles, John Wiley.
2. 'Foundation Design' by WC Teng, Prentice Hall Publishers.

CONSTRUCTION PLANNING AND MANAGEMENT

(Professional Elective – IV)

Subject Code: UGCE7T0920 L T P C

IV Year /I Semester 3 - - 3

Prerequisites: Knowledge in Building and Construction materials

COURSE OBJECTIVES: The course is designed

1. To study the process of construction planning.
2. To acquire knowledge in Planning of Construction by Various Network Technique Method.
3. To learn how to utilize Maximum Resources Efficiency.
4. To study the monitoring of projects through Project Management System.
5. To gain the knowledge of concept in Planning and Organizing.
6. To learn quality control and safety of construction projects.

SYLLABUS

UNIT-I: **8hrs**

CONSTRUCTION PLANNING: Definition of Projects; Stages of project planning, pre-tender planning, pre- construction planning, detailed construction planning, collection of data, role of client and contractor level of detail, Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities.

UNIT-II: **8hrs**

SCHEDULING PROCEDURE AND TECHNIQUES: Techniques of planning, Bar charts, Gantt Charts, Networks: basic terminology, types of precedence relationships, preparation of CPM network analysis, preparation of PERT analysis, Slack computations.

UNIT-III: **8hrs**

RESOURCE ALLOCATION: Allocation of Resources, materials, equipment, staff, labour and finance, Resource levelling, scheduling and forms of scheduling, resource smoothing.

UNIT-IV: **10hrs**

PROJECT MANAGEMENT SYSTEMS AND CONSTRUCTION METHODS:

Control & monitoring; Temporary Structures in Construction, Construction Methods for various types of Structures, Major Construction equipment, Modern Project management Systems, Advent of Lean Construction; Importance of Contracts Management, Project Delivery Methods: BOT, SBOO, BOOT, Public Private Partnership (PPP), Detailed Report (DPR)

UNIT-V: **8 hrs**

BASIC CONCEPT OF PLANNING AND ORGANIZING: Documentation at site; Manpower: planning, organizing, staffing; Materials, concepts of planning, procurement and inventory control, Equipment: basic concepts of planning and organizing, Funds: cash flow, sources of funds, Histograms and S-Curves. Earned Value

UNIT-VI: QUALITY CONTROL AND SAFETY IN CONSTRUCTION: 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, Introduction to Building Information Modelling (BIM), Safety, Health and Environment on project sites: accidents, causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health **8 hrs**

COURSE OUTCOMES: Upon successful completion of the course, the students will be able to

CO1: Utilize management skill for proper planning of project.

CO2: Plan a construction project using network analysis with respect to time.

CO3: Categorize resources in optimum way.

CO4: Plan and organize the resources in construction using Project Management Systems and Contract Management economically.

CO5: Exposed to the concepts of Quality control and Safety Regulation in Construction.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	3	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	-	-	3	-	-	-
CO4	3	3	-	3	-	-	-	-	-	-	3	-	-	-
CO5	3	-	-	-	-	3	3	-	-	-	-	-	-	-

TEXT BOOKS:

1. Ghalot, P.S. Dhir, D.M. construction Planning and Management, Wiley Eastern limited, 1992.
2. Chitkara, k.k., Construction Project Management, Tata McGraw hill Publishing Co, Ltd.,

New Delhi,1958.
3. Punmia,B.C., Project Planning and control with PERT and CPM, Laxmi Publications. New delhi, 1987.
4. Calin M. Popescu, Chotchal Charoenngam, “Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications”, Wiley, New York,2005.

REFERENCES:

1. Construction Management and Planning by: Sengupta, B.guha, h. Tata McGraw-Hill Publications

SATELLITE IMAGE PROCESSING

(Professional Elective - IV)

Subject Code: UGCE7T1020	L T P C
IV Year / I Semester	3 - - 3

Prerequisite: Nil

COURSE OBJECTIVES: The course is designed to

1. Outline the satellite images and characteristics.
2. Explain statics approach in satellite data sets.
3. Understand the satellite image processing
4. Understand interpretation techniques using satellite images
5. Understand image enhancement techniques.
6. Build the knowledge on satellite image classification

SYLLABUS

UNIT -1:

Introduction – Introduction to data sources, Characteristics of digital Image data, spatial data sources, Digital data acquisition, Digital Image Data formats, Image processing system considerations. **6hrs**

UNIT-2:

Initial Statistics Extraction – Univariate and Multivariate Statistics, Histogram – Contrast modification of Image data, Histogram Equalization, Histogram matching, Density slicing. **6 hrs**

UNIT-3:

Image Pre-processing – Sources and Corrections of Radiometric distortions, Sources and Corrections of Geometric distortions, Image registration **6hrs**

UNIT-4:

Interpretation of Digital Image Data – Approaches to Interpretation, Forms of Imagery for image interpretation, Computer processing for image interpretation, Quantitative analysis. **6 hrs**

UNIT-5: **10hrs**

Image Enhancements – Image Reduction & Magnification, Transects, Geometric Enhancement using Image Domain techniques – Neighborhood Operations, Template Operators, Convolution Operation, Spatial Filtering, Edge Detection, Line Detection, Texture, Spatial Correlation – The Semi variogram, Shape Detection.

14hrs

UNIT-6:

Classification – Supervised Classification – Maximum Likelihood, Minimum Distance, Parallelepiped, Other Supervised Classifications, Context Classifications, Non-parametric Classification – Linear Discrimination, Support Vector Classifier, Neural Network Approach, Unsupervised Classification – Delineation of Spectral Classes, Similarity metrics and clustering criteria, Iterative Optimization, Single pass Clustering Technique, Agglomerative Hierarchical Clustering, Clustering by Histogram Peak Selection, Classification Accuracy Assessment.

COURSE OUTCOMES: At the end of the course, student will be able to

CO1: Demonstrate satellite images processing and characteristics.

CO2: Interpret the statics techniques.

CO3: Illustrate satellite image processing.

CO4: Identify interpretation techniques.

CO5: Explain image enhancement techniques.

CO6: Apply classification techniques to satellite image.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	2	3	-	-	-	2	2	2	3	-	-
CO2	3	3	2	2	3	-	-	-	2	2	2	3	-	-
CO3	2	2	2	2	3	-	-	-	2	2	2	3	-	-
CO4	3	2	2	2	3	-	-	-	2	2	2	3	-	-
CO5	3	2	2	2	3	-	-	-	2	2	2	3	-	-
CO6	3	3	2	2	3	-	-	-	2	2	2	3	-	-

TEXT BOOK:

1. John, R. Jensen. Introductory Digital Image Processing – Prentice Hall, New Jersey, 1986
2. John A. Richards – XiupingJia. Remote Sensing Digital Image Analysis – An Introduction – Springer Berlin Heidelberg, New York.

REFERENCE BOOK:

1. Bhatta B (2008), 'Remote sensing and GIS', Oxford University Press.
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) 'Remote Sensing and Image Interpretation', Wiley India Pvt. Ltd., New Delhi

PRESTRESSED CONCRETE

(Professional Elective – V)

Subject Code: UGCE8T1120 L T P C
IV Year / I Semester 3 0 0 3

Prerequisites: Building Material, Building Construction, Reinforced cement concrete

COURSE OBJECTIVES:

1. Understand the concept of Prestressed Concrete members.
2. To Study the losses of PSC members

SYLLABUS

UNIT-I :

INTRODUCTION TO PRE-STRESSED CONCRETE: Historical development, General principles of pre-stressing, Pre stressing and post tensioning, Advantages and disadvantages of pre stressed concrete , High strength Concrete and characteristics as per IS Code provisions, High tensile steel and characteristics as per IS Code provisions, Ductility detailing provisions as per IS 13920 **7hrs**

UNIT-II :

METHODS AND SYSTEMS OF PRE-STRESSING: Pre tensioning methods, Post tensioning methods, Analysis of post tensioning, Different systems (Hoyer system, Magnel system, Freyssinet system and Gifford udall system, **7hrs**

UNIT-III :

LOSSES OF PRESTRESS : Introduction to various losses in Pre –tensioned and post- tensioned, Losses due to elastic shortage of concrete, Losses due to shrinkage of concrete, Losses due to creep of concrete, Losses due to relaxation of steel, Losses due to slip in anchorage bending of member, Losses due to frictional losses.. **7hrs**

UNIT-IV :

ELASTIC ANALYSIS OF PSC BEAMS : Elastic analysis of concrete beams prestressed with straight tendons, Elastic analysis of concrete beams prestressed with concentric tendons, Elastic analysis of concrete beams prestressed with eccentric tendons, Elastic analysis of concrete beams prestresse with bent tendons,
Elastic analysis of concrete beams prestresse with parabolic tendons. **10hrs**

UNIT-V : **9hrs**

ANALYSIS OF SECTIONS FOR FLEXURE & SHEAR : Allowable stress in PSC, Design criteria as per IS code, Elastic Design of simple rectangular sections for flexure & Shear, Elastic Design of simple I sections for flexure & shear, Design of shear in beams – Kern lines , cable profile

UNIT-VI :

ANALYSIS AND DESIGN OF ANCHORAGE ZONE: Analysis by Guyon's method, Analysis by Mugnel method, Design of anchorage zone reinforcement. **7hrs**

COURSE OUTCOMES: Upon the successful completion of this course, the student will be able to:

CO1: Demonstrate the concepts of pre-stressing in concrete structures and identify the behavior of materials prestressing.

CO2: Estimate the losses of prestressing.

CO3: Analyze a Prestressed concrete section.

CO4: Design Pre Tensioned and post tensioned member for flexure and shear.

CO5: Design Post-tensioned member for anchorage zone.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	2	-	-	3	-	-
CO3	2	3	-	2	-	-	-	-	2	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	2	-	-	3	-	-
CO5	2	3	3	-	-	-	-	-	2	-	-	3	-	-

TEXT BOOKS:

1. Reinforced concrete design buS.UnnikrishnaPillai & DevdasMenon, Tata Mc. Graw Hill, New Delhi.
2. Prestressed Concrete by Krishna Raju , Tata Mc. Graw Hill, New Delhi.

REFERENCES:

1. Reinforced concrete structural elements behaviour, Analysis and design by P.Purushotham, Tata Mc. Graw Hill, New Delhi, 1994
2. Reinforced concrete structures,Vol -1, by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain,Laxmi,publicationsPvt,Ltd. New Delhi.

DESIGN AND DRAWING OF IRRIGATION STRUCTURES

(Professional Elective – V)

Subject Code: UGCE8T1220 L T P C

IV Year / II Semester 3 0 0 3

Prerequisites: Fluid Mechanics, Water Resource Engineering

COURSE OBJECTIVES:

1. Understand design principle of various irrigation structures

SYLLABUS

1. 1.Surplusweir
2. Tank sluice with a towerhead
3. Canal drop-Notchtype
4. Canalregulator
5. Undertunnel
6. Syphon aqueduct type III

Note: Final Examination pattern: Any two question of the above six designs may be asked out of which the candidated has to answer one question. The duration of the examination is three hours.

COURSE OUTCOMES: Upon the successful completion of this course, the student will be able to:

CO1: Design various irrigation structures.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	3	-	2	2	-	-	-	-	-	3	3

TEXT BOOKS:

1. Water Resources Engineering – Principles and Practice by C. Satyanarayana Murthy, New age International Publishers.

REFERENCES:

1. Irrigation Engineering and Hydraulic Structures, S. K. Garg, Standard BookHouse
2. Irrigation and Water Power Engineering, B. C Punmia& Lal, Lakshmi Publications Pvt. Ltd., NewDelhi.

SOIL DYNAMICS AND MACHINE FOUNDATION

(Professional Elective - V)

Subject Code: UGCE8T1320 L T P C

IV Year / I Semester 3 0 0 3

Prerequisite: physics, soil mechanics and Mathematics.

COURSE OBJECTIVES: The objective of this course is

1. Develop the concepts simple harmonic motion and damping
2. Explain the student the concepts of Vibration analysis
3. Discuss the dynamic properties of soil
4. Design and analysis of machine foundations
5. Discuss about phenomena like liquefaction

SYLLABUS

UNIT I

INTRODUCTION: Types of motion- SHM- Fundamental definitions- SDOF systems- Free and forced vibration with and without damping - Constant force and rotating mass type excitation – Types of damping-Equivalent stiffness of springs in series and parallel. – Resonance and its effect - magnification-logarithmic decrement –Transmissibility

UNIT II

Theories of Vibration Analysis- EHS Theory and lumped parameter model- Different modes of vibration- Natural frequency of foundation soil system – Barkan and IS methods – Pressure bulb concept – Reisner Theory – Limitations of Reisner theory – Sung's solutions -- Pauw's Analogy – Heigh's Theory.

UNIT III

Dynamic properties of soils, Determination of E, G and Poisons ratio from field and laboratory tests, recommendations of Indian codes- Stress waves in bounded elastic medium- Use of wave theory in the determination of elastic properties, Elastic coefficients of soils and their determination- damping factor from free and forced vibration tests.– Block vibration test – Determination of Damping factor.

UNIT IV

Types of machine foundations – general requirements design – criteria for machine foundations, permissible amplitudes and bearing pressure Design data, design criteria, IS code provisions for the design foundations of reciprocating machines.

UNIT V

Design data, design criteria, IS code provisions for the design foundations of Impact type of machines

UNIT VI

VIBRATION ISOLATION: Transmissibility, Principles of isolation- Methods of isolation- Vibration isolators- Types and their characterizes Special Topics: Liquefaction of soils, CSR, CRR, Factor of safety against liquefaction - Dynamic bearing capacity, Earth retaining structures under dynamic loads

COURSE OUTCOMES: At the end of the course, the student will have to be able to

1. Categorize different types of motions
2. Understand the concepts of vibration analysis
3. Understand the concepts of dynamic properties of soils
4. Understand different types of machine foundations and design them.
5. Design foundations of impact machines following the IS provisions
6. Determine the factor of safety against liquefaction

CO-PO MAPPING

POS	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	2	2	2	-	-	-	-	-	-	-	-	-	-
CO5	-	2	2	2	-	-	-	-	-	-	-	-	-	-
CO6	2	-	-	2	-	-	-	-	-	-	-	-	-	-

TEXT BOOK:

1. 'Vibrations of Soils and Foundations' by Richart Hall and Woods

REFERENCES:

1. 'Vibration Analysis and Foundation Dynamics' by NSV Kameswara Rao, Wheeler Publishing, New Delhi.
2. 'Foundations of Machines- Analysis and Design' by Prakash and Puri.
3. 'Fundamentals of Soil Dynamics' by B M Das
4. 'Dynamics of bases and Foundations' by D D Barkar
5. 'Soil Dynamics & Machine Foundation' Swami Saran, Galgotia Publications

AIR POLLUTION & CONTROL

(Professional Elective – V)

Subject Code: UGCE8T1420 L T P C

IV Year / I Semester 3 0 0 3

Prerequisite: Knowledge on Environmental studies and chemistry are necessary.

COURSE OBJECTIVES:

1. To know the analysis of air pollutants
2. To know the thresholds limit value (TLV) of various air pollutants.
3. To acquire the design principles of particulate and gaseous control.
4. To learn plume behavior in different environmental conditions.
5. To learn carbon credits for various day to day activities.

SYLLABUS:

UNIT I: 7 hrs

Sources of Air pollution: Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications, Effects of Air pollutants on man, material and vegetation: Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holes

UNIT II: 8hrs

Thermodynamics and Kinetics of Air-pollution: Applications in the removal of gases like SOx, NOx, CO and HC Air-fuel ratio- Computation and Control of products of combustion Automobile pollution. Odour pollution control Flares.

UNIT III: 8 hrs

Meteorology and Air Pollution: Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena on plume behaviour and Air Quality Wind rose diagrams, Plume Rise Models

UNIT IV: 8 hrs

Ambient Air Quality Management: Monitoring of SPM, SO2; NOx and CO - Stack Monitoring for flue gases Micro-meteorological monitoring -Weather Station Emission Standards- Gaussian Model for Plume Dispersion.

UNIT V: 8 hrs

Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control Equipments – Settling Chambers, Cyclone separators –Fabric filters Wet scrubbers, Electrostatic precipitators.

UNIT VI: 8 hrs

Air Pollution Control Methods: Control of NOx and SOx emissions Environmental friendly fuels

- In-plant Control Measures process changes, methods of removal and recycling. Environmental criteria for setting industries and green belts.

COURSE OUTCOMES: Upon the successful completion of this course, the students will be able to:

CO1: Identify the effects of air pollutants

CO2: Determine the plume behavior for atmospheric stability conditions.

CO3: Apply plume dispersion modeling and assess the concentrations.

CO4: Design and operation of air pollution controlling devices.

CO5: Identify the applications and control measures for air pollution

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	-	-	-	-	2	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	3	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	2	-	-	-	-	-	-	-
CO4	-	-	3	2	2	-	-	-	-	-	-	-	-	-
CO5	-	2	3	-	2	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Air Pollution by M.N. Rao and H.V.N. Rao – Tata McGraw Hill Company.
2. Air Pollution and Control by KVSG Murali Krishna.
3. Environmental Pollution Control Engineering by C.S.Rao – New age international Publishers.

REFERENCES:

1. 1 An Introduction to Air pollution by R.K. Trivedy and P.K. Goel, B.S. Publications.
2. Air pollution by Wark and Warner - Harper & Row, New York

RAILWAYS, AIRPORTS AND HARBOR ENGINEERING

(Professional Elective – V)

Subject Code: UGCE7T1520	L T P C
IV Year / I Semester	3 0 0 3

Prerequisites: The student should know the basic concepts of Transportation engineering & should have the knowledge of mathematics

COURSE OBJECTIVES:

1. To know various components and their functions in a railway track
2. To acquire design principles of geometrics in a railway track.
3. To know various techniques for the effective movement of trains.
4. To acquire skills for planning, design, of airways for Airport runway geometry.
5. To acquire skills for construction and management of airways for Airport runway geometry.
6. To acquire skills for the planning, construction and maintenance of Docks and Harbors

SYLLABUS

RAILWAY ENGINEERING

UNIT 1:

COMPONENTS OF RAILWAY ENGINEERING: Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

UNIT 2:

GEOMETRIC DESIGN OF RAILWAY TRACK: Alignment – Engineering Surveys Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves.

UNIT 3:

TURNOUTS & CONTROLLERS: Track layouts – Switches – Design of Tongue Rails Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing. Signal Objectives – Classification – Fixed signals – Stop signals – Signaling systems –

Mechanical signaling system – Electrical signaling system – System for Controlling Train Movement – Interlocking – Modern signaling Installations

AIRPORT ENGINEERING

UNIT 4:

AIRPORT PLANNING & DESIGN: Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control

UNIT 5:

RUNWAY DESIGN: Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements – Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage

DOCKS AND HARBOURS

UNIT 6:

PLANNING, LAYOUT, CONSTRUCTION & MAINTENANCE OF DOCKS & HARBORS:

Classification of ports – Requirement of a good port – classification of Harbors – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts; Quays – construction of Quay walls – Wharves – Jetties – Tides - Tidal data and Analysis – Break waters – Dredging – Maintenance of Ports and Harbors – Navigational aids

COURSE OUTCOMES: Upon the successful completion of this course, the students will be able to:

CO1: Interpret the terminology and basics of railway engineering

CO2: Analyze the construction process, maintenance and operation of railway track

CO3: Demonstrate the concepts of various signaling systems, safety aspects of Indian Railways

CO4: Explain the impacts and demands of aircraft in their design of airport facilities

CO5: Plan, construct and maintain Docks and Harbors

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	-	-	-	2	-	3	3	-	-	-	-	3	-	-
CO2	2	2	2	-	-	3	3	-	-	-	-	3	-	2
CO3	-	-	-	-	-	3	3	-	-	-	-	3	-	-
CO4	2	2	2	2	-	3	3	-	-	-	-	3	-	2
CO5	-	-	-	-	-	3	3	-	-	-	-	3	-	2

TEXT BOOKS:

1. Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi
2. Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.
3. Docks and Harbor Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.

REFERENCES:

1. 'Railway Engineering' by Saxena & Arora - Dhanpat Rai, New Delhi.
2. 'Transportation Engineering Planning Design' by Wright P.H. & Ashfort N.J. - John Wiley & Sons.
3. 'Airport Engineering' by Virendra Kumar, Dhanpat Rai Publishers, New Delhi.
4. 'Transportation Engineering' by Srinivasa Kumar R, University Press, Hyderabad.
5. 'Highway, Railway, Airportand Harbor Engineering' by Subramanian KP, ScitechPublications (India) Pvt. Limited, Chennai

ESTIMATION SPECIFICATIONS AND CONTRACTS

(Open Elective/Job Oriented Elective)

Subject Code: UGCE7T1620	L	T	P	C
IV Year / I Semester	3	-	-	3

Prerequisite: Knowledge of Mathematics, Building components, reinforced concrete Structures

COURSE OBJECTIVES: The course is designed to -

1. Study various drawings & estimates using Centre line method and Long wall & short wall method
2. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil Engineering projects.
3. Rate Analysis and contracting details.
4. Understand and apply the concept of Valuation for Properties
5. Understand, Apply and Create the Tender and Contract document

SYLLABUS:

UNIT-I :

GENERAL ITEMS OF WORK IN BUILDING: Quantity Estimation for Building, Study of various drawing attached with estimates, Important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised. **8hrs**

UNIT-II :

ESTIMATION: Estimation of building - Short wall and long wall method, Estimation of building - center line method, Estimate of R.C.C structures including slab, beam, column, footings with bar bending schedule. **10hrs**

UNIT-III :

ESTIMATES: Estimate of Steel truss, manhole and septic tanks, Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads **10hrs**

UNIT-IV :

RATE ANALYSIS: Specification for Civil Engineering Works, Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings, Analysis of Rates: Factors Affecting Cost of Civil Works, Concept of Direct Cost, Indirect Cost and Project Cost, Rate analysis and preparation of bills, Data analysis of rates for various items of Works , Sub-structure components, Rate analysis for R.C.C. **8hrs**

slabs, columns and beams

UNIT-V :

CONTRACT MANAGEMENT-TENDER AND ITS PROCESS – POST AWARD: Invitation to tender, Prequalification, approval & sanction, submission and Evaluation, Contract Formulation, Types of Contract, Contract document, conditions of contract, Contract management and administration. Performance security, advances, Payments, Time limit, alterations and deviations, Escalation, claims, Delays and Compensation, Disputes & its resolution mechanism

7hrs

UNIT-VI :

VALUATION: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value, Concept of supply and demand in respect to properties (land, building, facilities'), freehold and lease hold, sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land. **8hrs**

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1: Demonstrate the basic knowledge on estimation of different components of civil engineering structures and specifications
CO2: Analyze estimates for different items of work and rate specifications
CO3: Prepare contracts, tenders and valuation reports for various civil engineering projects
CO4: Estimate quantities and cost of a structure using appropriate technique

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	3	2	-	-	-	2	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	2	-	2	2	-	-	-	-	-
CO4	2	-	-	-	-	2	-	2	2	-	2	-	-	-

TEXT BOOKS:

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi

REFERENCES:

1. Kohli D.D and Kohli R.C, “Estimating and Costing", 12th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, “Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015
4. Duncan Cartlidge , "Quantity Surveyor’s Pocket Book", Routledge Publishers, 2012

QUANTUM GIS

(Open Elective/Job Oriented Elective)

Subject Code: UGCE7T1720 L T P C

IV Year / I Semester 2 - 2 3

Prerequisite: Basic concepts of Remote sensing and GIS Application

COURSE OBJECTIVES:

1. To understand the important FOSS tools in GIS applications
2. To Learn the Data extraction using QGIS
3. To learn the external tools usage in QGIS
4. To understand GIS analysis using QGIS.

SYLLABUS

EXP 1: QGIS Menu and Toolbars

EXP 2: Geo-referencing and Projection

EXP 3: Creating and Editing the Shape Files

EXP 4: Tables and Querying the Data

EXP 5: Symbolizing the Features

EXP 6: Map Composer

COURSE OUTCOMES:

CO1: Exposure of FOSS Importance.
CO2: Creation of Geospatial data.
CO3: Know the extensions importance and usage in QGIS
CO4: Learn about tables and quarrying
CO5: Learn to creation of features symbolization
CO6: Learn Google earth linking, extraction.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	2	-	2	-	-	-	2	-	2	3	-	-
CO2	2	2	2	-	2	-	-	-	2	-	2	3	-	-
CO3	2	2	2	-	2	-	-	-	2	-	2	3	-	-
CO4	2	2	2	-	3	-	-	-	2	-	2	3	-	-
CO5	2	2	2	-	-	-	-	-	2	-	2	3	-	-
CO6	2	2	2	-	2	-	-	-	2	-	2	3	-	-

ROAD SAFETY MANAGEMENT

(Open Elective/Job Oriented Elective)

	L	T	P	C
Subject Code: UGCE7T1820				
IV Year / I Semester	2	-	2	3

Prerequisites: Awareness about traffic rules and road accidents

COURSE OBJECTIVES:

- To acquire knowledge and understanding of the road environment.
- To inculcate decision making and behavioral skills necessary to survive in the road environment.
- To impart knowledge and understanding of the causes and consequences of accidents.
- To understand roles and responsibilities in ensuring road safety.
- To create awareness on traffic management systems and road safety audit process

SYLLABUS

UNIT I:

INTRODUCTION TO ROAD SAFETY **(6 Hrs)**

Road traffic accidents scenario in India and in world. Road Safety and its importance. Traffic Rules and Driving Behavior. Characteristics of accidents, accidents vs. crash.

UNIT II: **(6 Hrs)**

PLANNING FOR ROAD SAFETY

Awareness about rules and regulations of traffic. Assisting Traffic control authorities. Multidisciplinary approach to planning for traffic safety and injury control. Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled.

UNIT III: **(8 Hrs)**

RESPONSIBILITY OF ROAD ACCIDENTS AND SAFETY MEASURES

People responsible for accident prevention: Police, Politicians, Community members, Policy makers, Teachers, Parents, Infrastructure authorities, Drivers and Official road safety body. Reasons of students/ children have accidents. 4 E's of Accidents Prevention: 1. Engineering - by altering the environment 2. Enforcement - by imposing laws 3. Encouragement - by the use of publicity campaigns 4. Education - by gaining and using knowledge.

UNIT IV: **(6 Hrs)**

ROAD SAFETY EDUCATION

Introduction to Road Safety Education. 5 P's of Road safety education: 1. Pre-school road safety education 2. Practical rather than theory education 3. Principles of own development as regards to road safety education 4. Presentations on road safety education 5. Place for road safety education in syllabus

UNIT V: **(6 Hrs)**

ROAD SAFETY EVENTS

Discussions on efforts done by Government on Road Safety. Celebration of Road Safety week or Workshop on Road Safety week/ Organization of seminar on Road Safety. This is to be entirely organized by students under the mentorship of concerned Head of the Department.

UNIT-VI: **(7Hrs)**

TRAFFIC MANAGEMENT AND ROAD SAFETY AUDIT

Traffic management systems for safety, Road safety Audits and tools for safety management systems, Road safety audit process, Approach to safety, Road safety improvement strategies, ITS and safety.

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1: To assess the driving behavior of road users and understand the planning aspects with respect to road safety.

CO2: To identify various reasons for the cause of road accidents and to learn about the policy, rules and regulations of road safety measures.

CO3: To engage stakeholders in road safety events like road safety weak program, workshops and seminars etc.,

CO4: To familiarize on road safety auditing process and traffic management systems.

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	-	-	-	3	-	2	2	-	-	-	-	-
CO2	2	-	-	-	-	3	-	2	2	-	-	-	-	-
CO3	2	-	-	-	-	3	-	2	2	-	-	-	-	-
CO4	2	-	-	-	-	3	-	2	2	-	-	-	-	-

TEXT BOOKS:

1. Kadiyali L.R., Traffic Engineering & Transport Planning, Khanna Publishers, 2003.
2. CROWN AGENTS Ref: TEA/A369, 1995(Unpublished contractors report for Ministry of Transport and communications, Ghana). Road safety study and the institutional strengthening of the vehicle examination and licensing division.
3. TRRL OVERSEAS UNIT, 1991. Towards safer roads in developing countries: a guide for planners and engineers. Crown throne: Transport and Road Research Laboratory.

REFERENCES:

1. Handbook of Road Safety measures, Second Edition, Rune Elvik, Alena HOye, Truls Vaa, Michael Sorenson.
2. Road safety by NCHRP.
3. Indian Road Congress, Highway Safety Code, IRC: SP-44:1996
4. Indian Road Congress, Road Safety Audit Manual, IRC: SP-88-2019.

MANAGEMENT SCIENCE
(Common to all branches)

Subject Code : UGMB7T0120 **L T P C**
IV Year / I Semester **3 0 0 3**

Prerequisites:

- General awareness about Principles of Management.
- To have an insight about Production and Operations Management.
- To be able to acquire knowledge about Human Resource Management, Marketing, Strategic Management.

Course Objectives:

1. To create awareness about different Managerial concepts like Management, Production, Marketing, Human Resource and Strategic Management.
2. To make the students equip with knowledge on techniques of PERT and CPM in project management.

SYLLABUS:

UNIT-I: **[8 Hrs]**

Introduction to Management : Concept and importance of Management, Functions of management, Evaluation of Management thought, Fayol's principles of Management, Maslow's need hierarchy & Herzberg's two factor theory of Motivation, Decision making process, Designing organizational structure, Principles of Organization, Types of organization structures.

UNIT-II: **[8 Hrs]**

Operations Management : Plant Location Principles and types of plant Layout , Work study, Materials Management: Objectives - Need for inventory control- Inventory control techniques EOQ , ABC, HML, SDE, VED and FSN analysis.

UNIT-III: **[8 Hrs]**

Human Resources Management (HRM): Concepts of HRM, Basic functions of HR manager, Job Evaluation and Merit Rating, Performance Appraisal, Methods of Performance appraisal Concepts Compensation.

UNIT-IV: **[8 Hrs]**

Marketing Management: Functions of marketing, Marketing Mix, Marketing strategies based on Product life cycle, Channels of distribution (Place), Promotional Mix.

UNIT-V: **[10 Hrs]**

Project Management (PERT/CPM): Network analysis, Program Evaluation and Review Technique (PERT), Critical path method (CPM) - Identifying critical path, Difference between PERT & CPM (simple problems).

UNIT-VI: **[8 Hrs]**

Strategic Management: Mission, Goals, objectives, policy, strategy, Environmental scanning, SWOT analysis, Steps in strategy formulation and implementation Generic strategy alternatives.

Course Outcomes:

Upon completing the course, student will be able to

COs	Description	Blooms Level
CO 1	Understand the fundamentals of Management with specific insight as its function and role	Understanding
CO 2	Learn the concepts of production, Management of human Resources and Management of Marketing activities along with business environment	Understanding
CO 3	Apply the problem solving skills to demonstrate logical solution to real life problems	Applying
CO 4	Create the awareness of business strategies to deal with the dynamic business environment	Creating

Mapping of COs to POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO 1	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO 2	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	2	-	-	-

Text Books:

T1. Dr. Arya Sri, "Management Science", TMH 2011.

T2. L.M. Prasad, "Principles & Practices of Management" Sultan chand & Sons, 2007.

Reference Books:

R1. K. Aswathappa and K. Sridhara Bhat, "Production and Operations Management", Himalaya Publishing House, 2010.

R2. Philip Kotler Philip Kotler, Kevin Keller, Mairead Brady, Malcolm Goodman, Torben Hansen, "Marketing Management" Pearson Education Limited, 2016.

ANSYS
(Skill Oriented Course)

Subject Code: UGCE7K1920 L T P C
IV Year / I Semester 1 - 2 2

COURSE OBJECTIVES:

1. To understand the basics of Finite Element Analysis
2. Know the basic GUI of ANSYS
3. Introduce Engineering data
4. To discuss and model complex materials, assemblies and nonlinear behavior

LIST OF EXPERIMENTS

EXP 1: Overview of Finite Element Analysis; Introduction to nodes and elements

EXP 2: Meshing and different types of meshing

EXP 3: Introduction to ANSYS Workbench; Overview of different analysis systems available in ANSYS Workbench

EXP 4: Creating and saving the project

EXP 5: Overview of various material libraries provided by ANSYS

EXP 6: Creation of new material; Adding a material for analysis

EXP 7: ANSYS SpaceClaim: Creation of simple geometry in SpaceClaim

EXP 8: Introduction to static Structural Analysis

EXP 9: Basic composite structure problem

COURSE OUTCOMES:

CO1: Test for variables virtually to simulate the many possible scenarios and ultimately create the safest systems possible.
CO2: Develop models into ANSYS Workbench environment, view and analyze designs
CO3: Make use of ANSYS interface and Workbench to solve static structural problem

Mapping of COs to PO

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	-	2	2	-	-	-	-	-	-	2	-	-
CO2	-	-	3	2	2	-	-	-	-	-	-	2	-	-
CO3	2	2	2	2	2	-	-	-	-	-	-	2	-	-

INDUSTRIAL/RESEARCH INTERNSHIP

Subject Code: UGCE7I2020	L T P C
IV Year / I Semester	- - - 3

To be completed after III Year and evaluated in this semester

IV – II

MAJOR PROJECT & INTERNSHIP

(6 Months Duration)

Subject Code: UGCE8J0120	L	T	P	C
IV Year / II Semester	-	-	20	10

SEMINAR

Subject Code: UGCE8S0220	L T P C
IV Year / II Semesters	- 2 - 2