IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7T19 - DESIGN & DETAILING OF STEEL STRUCTURES

Course Learning Objectives:

- Familiarize Students with different types of Connections and relevant IS codes.
- Equip the Student with concepts of design of flexural members, tension and compression members in trusses.
- Familiarize students with different types of Columns and column bases and their design, Plate girder and Gantry Girder and their design.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Memorize the important connections in bolting and welding as per IS code requirements.	Knowledge
CO2	Design laterally supported and unsupported beams as per IS code	Design
CO3	Design of Tension and Compression members	Design
CO4	Practice the lacing and batten members used in steel columns as compression members	Applying
CO5	Design of beam to beam, abeam to column connections.	Applying
CO6	Design of plate girder by using limit state method as per IS code recommendations.	Design

SYLLABUS:

UNIT – I

Connections: Bolted connections – definition, bolt strength and capacity, Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT – II

Beams: Design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.

UNIT –III

Tension Members and compression members: General Design of members subjected to direct tension and bending –effective length of compression members. Slenderness ratio – permissible stresses. Design of compression members and struts.

Roof Trusses: Different types of trusses – Design loads – Load combinations as per IS Code recommendations, structural details –Design of simple roof trusses involving the design of purlins, members and joints – tubular trusses.

UNIT – IV

Design of Columns: Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns. Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected moment.

UNIT- V

Design of Beam to Beam, Beam to Column Connections: Framed connections, unstiffened seat connections, stiffened seat connections.

UNIT – VI

Design of Plate Girder: Design consideration – I S Code recommendations Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections.

INTERNAL EXAMINATION PATTERN:

The total internal marks (40) are distributed in two components as follows:

- Descriptive (subjective type) examination: 30marks
- Assignment: 10 marks

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Text Books:

1. Design of steel structures as per Limit State Method of Design by S.S.Bavakati, International Publishing House Pvt.Ltd.
2. ‘Steel Structures Design and Practice’ by N.Subramanian, Oxford University Press.
3. ‘Limit state Design of steel structures’ by S.K. Duggal, Tata Mcgraw Hill, and New Delhi.

IS Codes:

1. IS -800 – 2007
2. IS – 875
3. Steel Tables. (These codes and steel tables are permitted to use in the examinations).

Web References:

1. http://nptel.ac.in/courses/105106112/
2. http://nptel.ac.in/courses/105106113/

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7T20 - ENVIRONMENTAL ENGINEERING – II

Course Learning Objectives:

The objective of this course is:

- Outline planning and the design of wastewater collection, conveyance and treatment systems for a community/town/city.
- Provide knowledge of characterisation of wastewater generated in a community.
- Impart understanding of treatment of sewage and the need for its treatment.
- Summarize the appurtenance in sewerage systems and their necessity.
- Teach planning, and design of septic tank and imhoff tank and the disposal of the effluent from these low cost treatment systems.
- Effluent disposal method and realise the importance of regulations in the disposal of effluents in rivers.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Know the different types of sewerage systems and storm drains.	Knowledge
CO2	Understand the pumping of waste water and house plumbing.	Understand
CO3	Examine the Sewerage characteristics and treatment of sewerage.	Analysis
CO4	Demonstrate the mechanism for the removal of impurities from the sewerage systems.	Analysis
CO5	Design of septic tank and Imhoff tanks.	Creating
CO6	Analyse the available disposal options and their practical implications	Applying

SYLLABUS:

UNIT – I

Introduction to sanitation – systems of sanitation – relative merits &demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers - Hydraulics of sewers and storm drains– design of sewers – appurtenances in sewerage – cleaning and ventilation of sewers.

UNIT – II

Pumping of wastewater: Pumping stations – location – components– types of pumps and their suitability with regard to wastewaters.

House Plumbing: Systems of plumbing-sanitary fittings and other accessories–one pipe and two pipe systems – Design of building drainage.

UNIT – III

Sewage Characteristics – Sampling and analysis of wastewater - Physical, Chemical and Biological Examination-Measurement of BOD and COD -BOD equations.

Treatment of sewage: Primary treatment-Screens-grit chambers-grease traps–floatation–sedimentation – design of preliminary and primary treatment units.

UNIT – IV

Secondary treatment: Aerobic and anaerobic treatment process-comparison.

Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons.

Attached Growth Process: Trickling Filters–mechanism of impurities removal-classification–design-operation and maintenance problems. RBCs, Fluidized bed reactors.

UNIT - V

Miscellaneous Treatment Methods: Nitrification and Denitrification – Removal of Phosphates –UASB–Membrane reactors-Integrated fixed film reactors. Anaerobic Processes: Septic Tanks and Imhoff tanks- working Principles and Design–disposal of septic tank effluent.

UNIT – VI

Bio-solids (Sludge) management: Characteristics- handling and treatment of sludge-thickening – anaerobic digestion of sludge.

Disposal of sewage: methods of disposal – disposal into water bodies-Oxygen Sag Curve-disposal on land- sewage sickness.

Text Books:

1. Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.
2. Elements of Environmental Engineering by K.N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.
3. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.

4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Sham R Asolekar, Mc-GrawHill, NewDelhi; 3rd Edition.

References:

1. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, by Garg, S.K.; Khanna Publishers.
2. Sewage treatment and disposal by Dr. P.N. Modi&Sethi.
3. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003.
4. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7T21 - REMOTE SENSING & GIS APPLICATIONS

Course Learning Objectives:

The course is designed to:

- Introduce the basic principles of Remote Sensing and GIS techniques.
- Learn various types of sensors and platforms.
- Learn concepts of visual and digital image analyses.
- Understand the principles of spatial analysis.
- Appreciate application of RS and GIS to Civil engineering.

Course outcomes:

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

Course outcome	Description	Cognitive level
CO1	Distinguish between the principles of photogrammetry and Remote sensing.	Analysing
CO2	To understand the different types of platforms and sensors.	Understand
CO3	Know the concept of visual and digital image analysis	Remembering
CO4	Demonstrate the fundamentals of geographic information system	Understanding
CO5	Understand the principles of spatial data analysis	Understanding
CO6	Apply the knowledge of Remote Environmental sensing in disciplines of civil engineering	Applying

SYLLABUS:

UNIT – I

Introduction to Remote Sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces characteristics of remote sensing systems.

Sensors and Platforms: Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT.

UNIT – II

Image Analysis: Introduction, elements of visual interpretations, digital image processing-image pre-processing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT – III

Geographic Information System(GIS): Introduction, key components, application areas of GIS, map projections. Data entry and preparation: spatial data input, raster data models, vector data models.

UNIT – IV

Spatial Data Analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing.

UNIT – V

RS and GIS applications General: Land cover and land use, agriculture, forestry, geology, geomorphology, urban applications.

UNIT - VI

Application to Hydrology and Water Resources: Flood zoning and mapping, groundwater prospects and potential recharge zones, watershed management.

Text Books:

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.
3. Schowenger, R. A (2006) 'Remote Sensing' Elsevier publishers.
4. 'Fundamentals of Remote Sensing' by George Joseph, Universities Press, 2013.
5. 'Fundamentals of Geographic Information Systems' by Demers, M.N, Wiley India Pvt. Ltd, 2013.

References:

1. 'Remote Sensing and its Applications' by Narayan LRA, Universities Press, 2012.
2. 'Concepts and Techniques of Geographical Information System' by Chor Pang Lo and A K W Yeung, Prentice Hall (India), 2006.
3. 'Introduction to Geographic Information Systems' by KandTsung Chang, McGraw Hill Higher Education, 2009.

4. 'Basics of Remote sensing & GIS' by Kumar S, Laxmi Publications, New Delhi, 2005.
5. 'Principals of Geographical Information Systems' by Burrough P A and R.A. McDonnell, Oxford University Press, 1998.

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7T22 - WATER RESOURCE ENGINEERING-II

Course Learning Objectives:

The course is designed to:

- Introduce the types of irrigation systems.
- Introduce the concepts of planning and design of irrigation systems.
- Discuss the relationships between soil, water and plant and their significance in planning an irrigation system.
- Understand design methods of erodible and non-erodible canals.
- Know the principles of design of hydraulic structures on permeable foundations.
- Know the concepts for analysis and design principles of storage and diversion head works.
- Learn design principles of canal structures.
- Know about the major differences between super passage and Aqua duct.

Course Outcomes:

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

Course Outcomes	Description	Cognitive Level
CO1	Apply the design principles of cross drainage works	Analyzing
CO2	Estimate the life of reservoir and storage capacity	Remembering
CO3	Demonstrate the behaviour of particular irrigation structures and design principles and construction features	Understanding
CO4	Design of super passage and canal regulator.	Understanding
CO5	Differentiate between the earthen dam and gravity dam.	Comprehension
CO6	Understand about river training works and interlocking system.	Understand

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.

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, design of lined canal.

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.

UNIT - IV

Reservoir Planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.

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

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

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.

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.

UNIT - VI

Canal Structures Falls: Types and location, design principles of Sarda type fall, trapezoidal notch fall and straight glacis fall.

Regulators: Head and cross regulators, design principles.

Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and super passage.

Outlets: types, proportionality, sensitivity and flexibility.

River Training: Objectives and approaches, interlocking system of rivers

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'byAsawa G L (2013), New Age International Publishers.
3. 'Irrigation Engineering'byRaghunath H.M (2012), Wiley India.
4. 'Irrigation Water Resources and Water Power Engineering'byModi P N (2011), Standard Book House, New Delhi.

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'bySatyanarayana Murthy Challa (2008), New Age International Publishers.
4. Concrete dams by Varshney, Oxford and IBH publishers.

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D01 - FINITE ELEMENT METHOD

(Elective –I)

Course Learning Objectives:

The objective of this course is:

- Equip the students with the fundamentals of Finite Element Analysis.
- Enable the students to formulate the design problems into FEA.
- Enable the students to solve Boundary value problems using FEM.

Course Outcomes:

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

Course Outcomes	Description	Cognitive Level
CO1	Understand the concept behind variational methods and weighted residual methods in FEM	Understand
CO2	Identify the applications and characterstics of FEA Elements of Bars, Beams, Planes and isoparametric Elements	Applying
CO3	Apply the suitable boundaryconditions to a Global stiffness Equation and reduce it to a solvable form.	Applying
CO4	Identify the FEM Expands the beyond the structural domain, For problems involving in Dynamics.	Applying
CO5	Compute Stresses and Strains and interpret the result.	Creating
CO6	Understand the concept of iso-paramatric formulation	Understand

SYLLABUS:

UNIT-I

Introduction: Review of stiffness method- Principle of Stationary potential energy-Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation.

UNIT-II

Principles of Elasticity- Equilibrium Equations- Strain Displacement relationships- Constitutive relationship for plane stress, plane stain and axi-symmetric bodies of revolution with axi symmetric loading.

UNIT-III

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix –Selection of approximate displacement functions-solution of a plane truss-transformation matrix- Galerkin's method for 1-D truss – Computation of stress in a truss element.

UNIT-IV

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples on Analysis of beams Subjected to Concentrated and Distributed loading.

UNIT-V

Finite element formulation for plane stress and plane strain- Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces.

UNIT-VI

Iso-parametric Formulation: An iso-parametric bar element- plane bilinear iso-parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature for performing numerical integrations.

Text Books:

1. 'A first course in the Finite Element Method' by Daryl L. Logan, Thomson Publications.
2. 'Introduction to Finite Elements in Engineering' by Tirupati R. Chandrupatla, Ashok D. Belgundu, PHI publications.

References:

1. 'Concepts and applications of Finite Element Analysis'by Robert D. Cook, Michael E Plesha, John Wiley & sons Publications.
2. 'Text book of Finite Element Analysis' by P. Seshu, Prentice Hall of India.

IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D02 - GROUND IMPROVEMENT TECHNIQUES

(Elective –I)

Course Learning Objectives:

- To make the student how to improving the properties of remoulded and in-situ soils by adopting different ground improvement techniques such as compaction, dewatering systems, vibration methods etc.
- To enable the students to know how reinforced soil can be used to improve the engineering properties of soils.
- To make the student understand how to stabilize the different types of poor quality soils.

Course Outcomes:

Course outcome	Description	Cognitive level
CO1	Identify the ground conditions and suggest the methods of improvement.	Knowledge
CO2	Design a reinforced earth embankment and check its stability.	Creating
CO3	Understand the concepts and applications of grouting and availability of grouting.	Understand
CO4	Identify the soil stabilisation methods for pavement construction.	Applying
CO5	Adopt the suitable techniques occurring at the low densities and cracks on pavement.	Creating
CO6	Understand the behaviour of problematic soil.	Understand

SYLLABUS:

UNIT- I

In-situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ Densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns and lime columns - thermal methods.

UNIT -II

Dewatering – sumps and interceptor ditches – single and multi-stage well points – vacuum well points – horizontal wells-foundation drains-blanket drains – criteria for choice of filler material around drains – electro osmosis.

UNIT- III

Stabilization of soils – methods of soil stabilization – mechanical – cement –lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

UNIT- IV

Reinforce earth – principles – components of reinforced earth – design principles of reinforced earth walls-factors governing design of reinforced earth walls – stability checks – soil nailing.

UNIT- V

Geosynthetics – geotextiles – types – functions, properties and applications –geogrids, geomembranes and gabions - properties and applications.

UNIT-VI

Grouting – objectives of grouting – grouts, properties and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – post grout tests.

Text Books:

1. 'Ground Improvement Techniques'byPurushotham Raj, Laxmi Publications, New Delhi.
2. 'Ground Improvement Techniques' by NiharRanjanPatro, Vikas Publishing House (P) Limited, New Delhi.

References:

1. 'Ground Improvement' by MP Moseley, Blackie Academic and Professional, USA.
2. 'Designing with Geosynethetics' by RM Koerner, Prentice Hall.
3. 'An introduction to Soil Reinforcement and Geosynthetics' by G.L.Siva Kumar Babu, Universities Press.

Web References:

1. nptel.ac.in/courses/105104034/

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IV Year-I Semester **L T P C**

3 1 0 3

16CE7D03 - Air Pollution & Control

(Elective –I)

Course Learning Objectives:

The course will address the following:

- To know the analysis of air pollutants.
- To know the Threshold Limit Values (TLV) of various air pollutants.
- To acquire the design principles of particulate and gaseous control.
- To learn plume behaviour in different environmental conditions.
- To learn carbon credits for various day to day activities.

Course Learning Outcomes:

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

Course Outcomes	Description	Cognitive Level
CO1	Understand and analysis of airpollutants with climatic change and its impact.	Understand
CO2	Design principles of particulate and gaseous control measures for an industry	Create
CO3	Examine the plume behaviour in a prevailing environmental condition	Evaluation
CO4	Know the design process for gases pollutant	Create
CO5	Categorise industries with respect to site selection, zoning,legislation and emission standards.	Knowledge
CO6	Know the source of soil contamination and water quality analysis.	Knowledge

SYLLABUS:

UNIT – I

Air Pollution: Sampling and analysis of air pollutants, conversion of ppm into μg/m3. Definition of terms related to air pollution and control, classification of air pollutants - secondary pollutants - Indoor air pollution - Climate Change and its impact -Carbon Trade.

UNIT-II

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

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

Ambient Air Quality Management: Monitoring of SPM, SO_2; NOx and CO - Stack Monitoring for flue gases - Micro-meteorological monitoring - Weather Station. Emission Standards-Gaussian Model for Plume Dispersion.

UNIT-V

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

UNIT – VI

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.

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, Laxmi Publications, New Delhi.

Reference:

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.

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D04 - URBAN HYDROLOGY

(Elective –I)

Course Learning Objectives:

The course is designed to:

- Appreciate the impact of urbanization on catchment hydrology
- Understand the importance of short duration rainfall runoff data for urban hydrology studies.
- Learn the techniques for peak flow estimation for storm water drainage system design.
- Understand the concepts in design of various components of urban drainage systems.
- Learn some of the best management practices in urban drainage.
- Understand the concepts of preparation master urban drainage system.

Course Outcomes:

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

Course Outcomes	Description	Cognitive Level
CO1	Develop intensity duration frequency curves for urban drainage systems.	Applying
CO2	Estimate the urban waste water in disposal system by using Particular methods	Evaluating
CO3	Design the Individual components of urban drainage systems.	Creating
CO4	Formulate for best management practices in urban drainage system.	Creating
CO5	Prepare master plan of drainage system for urbanized area.	Applying
CO6	Knowledge on urbanization and urban water system	Knowledge

SYLLABUS:

UNIT - I

Introduction: Urbanisation and its effect on water cycle – urban hydrologic cycle – trends in urbanisation – Effect of urbanisation on hydrology.

UNIT - II

Precipitation Analysis: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration - Frequency (IDF) curves, design storms for urban drainage systems.

UNIT - III

Approaches to urban drainage: Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse, major and minor systems.

UNIT - IV

Elements of drainage systems: Open channel, underground drains, appurtenances, pumping, and source control.

UNIT - V

Analysis and Management: Storm water drainage structures, design of storm water network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for storm water management.

UNIT - VI

Master drainage plans: Issues to be concentrated upon – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, and use of models in planning.

Text Books:

1. 'Manual on Drainage in Urbanised area'by Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, (1987 - 2 volumes), UNESCO.
2. 'Urban Hydrology' by Hall M J (1984), Elsevier Applied Science Publisher.
3. 'Hydrology – Quantity and Quality Analysis' by Wanielista M P and Eaglin (1997), Wiley and Sons.
4. 'Urban Hydrology, Hydraulics and Storm water Quality: Engineering Applications and Computer Modelling' by Akan A.O and R.L. Houghtalen (2006), Wiley International.

References:

1. 'Storm water Detention for Drainage' by Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall.
2. 'Urban water cycle processes and interactions' by Marsalek et al (2006), Publication No. 78, UNESCO, Paris.

3. ‘Frontiers in Urban Water Management – Deadlock or Hope’ by Maksimovic C and J A Tejada-Guibert (2001), IWA Publishing.

Web References:

1. http://nptel.ac.in/courses/105105048/M7L7.pdf
2. http://nptel.ac.in/courses/105105048/8
3. http://njscdea.ncdea.org/CurveNumbers.pdf
4. http://www.iitg.ac.in/kartha/CE551/Lectures/Lecture16.pdf

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D05 - REPAIR & MAINTENANCE OF STRUCTURES

(Elective –I)

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with deterioration of concrete in structures.
- Equip student with concepts of NDT and evaluation.
- Understand failures and causes for failures in structures.
- Familiarize different materials and techniques for repairs.
- Understand procedure to carryout Physical evaluation of buildings and prepare report.

Course Outcomes:

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

Course Outcomes	Description	Cognitive Level
CO1	Understand deterioration of concrete in structures	Knowledge
CO2	Evaluate structures by NDT	Applying
CO3	Assess failures and causes of failures in structures.	Evaluation
CO4	Understand repair and rehabilitation techniques	Knowledge
CO5	Carryout Physical evaluation and submit report on condition of the structure.	Applying
CO6	Application of materials for repair and rehabilitation	Applying

SYLLABUS:

UNIT - I

Deterioration of concrete in structures: Physical processes of deterioration like Freezing and Thawing, Wetting and Drying, Abrasion, Erosion, Pitting, Chemical processes like Carbonation, Chloride ingress, Corrosion, Alkali aggregate reaction, Sulphate attack Acid attack, temperature and their causes, Mechanism, Effect, preventive measures. - Cracks: Cracks in concrete, type, pattern, quantification, measurement & preventive measures.

UNIT- II

Non Destructive Testing- Non-destructive test methods for concrete including Rebound hammer, Ultrasonic pulse velocity, Rebar locator, Corrosion meter, Penetration resistance

and Pull out test, Core cutting- Corrosion: Methods for corrosion measurement and assessment including half-cell potential and resistivity, Mapping of data.

UNIT- III

Failure of buildings: Definition of building failure-types of failures- Causes of Failures- Faulty Design, Accidental over Loading, Poor quality of material and Poor Construction practices- Fire damage - Methodology for investigation of failures-diagnostic testing methods and equipment's-repair of cracks in concrete.

UNIT- IV

Materials for repair and rehabilitation -Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Concrete behaviour under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

UNIT - V

Repair Techniques: Grouting, Jacketing, Shotcreting, externally bonded plates, Nailing, Underpinning and under water repair; Materials, Equipments, Precautions and Processes.

UNIT - VI

Investigation of structures: Distress, observation and preliminary test methods. Case studies: related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion and erosion damaged structures.

Text Books:

1. 'Maintenance & Repair of Civil Structures' by B.L. Gupta & Amit Gupta.
2. 'Rehabilitation of Concrete Structures' by B. Vidivelli, Standard Publishers.
3. 'Concrete Bridge Practice Construction, Maintenance & Rehabilitation' by V. K. Raina.

References:

1. 'Concrete Structures- protection Repair and Rehabilitation' by R. Doodge Woodson, BH Publishers.

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D06 - TRAFFIC ENGINEERING

(Elective –I)

Course Learning Objectives:

- To know various components and characteristics of traffic.
- To know various traffic control devices and principles of highway safety.
- To understand the detrimental effects of traffic on environment.
- To know highway capacity and level of service concepts.
- To learn about intelligent vehicle highway systems.

Course Outcomes:

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

Course Outcomes	Description	Cognitive Level
CO1	Discover Parking Problems and manage traffic regulations	Create
CO2	Determine traffic speed, volume, travel time and Density	Analyzing
CO3	Design traffic signals.	Remembering
CO4	Discover traffic-environment problems.	Create
CO5	Build Knowledge of traffic Capacity and Level OF service	Remembering
CO6	Develop vehicle highway systems.	Applying

SYLLABUS:

UNIT- I

Components Of The Traffic System: Human-Vehicle–Environment System; characteristics of Road users, Vehicles, Highways and their classification; Traffic Studies: Inventories; Volume studies; Speed, Travel time and Delay studies; Intersection studies; Pedestrian studies; Parking studies; Accident studies. Types of parking facilities – On street parking and Off-street Parking facilities; Parking studies and analysis- Parking Inventory Study, Parking Usage Study By Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation of parking parameters; Parking accumulation, Parking Load, Parking Turnover, Parking Volume, Parking Index.

UNIT- II

Traffic Characteristics: Microscopic and macroscopic flow characteristics: Time headways; Temporal, spatial and model flow patterns; Interrupted and Un interrupted traffic. Microscopic and macroscopic speed characteristics: Vehicular speed Trajectories; Speed characteristics – Mathematical distribution; Speed and travel time variations; Travel time and delay studies. Microscopic and Macroscopic density characteristics: Distance headway characteristics; Car-following theories; Density measurement techniques; Density contour maps.

UNIT- III

Traffic Control Devices & Highway Safety: Traffic signs & Markings; Signal Warrants; Signal phasing and Development of phase plans; Fixed and Vehicle activated signals; Webster method; ARRB method; Drew's Method; IRC method; Signal coordination; Area Traffic control. Accident characteristics – Road – Driver – Vehicle; Accident recording and Analysis; Highway Safety Improvement Program; Safety Audit.

UNIT- IV

Environmental Considerations: Air pollution: Kinds of pollutants; Air pollution standards; Measures of air quality; modelling and control. Noise pollution: Measurement of sound levels; Acceptable limits, Prediction of noise levels, Traffic noise control. Measures to curtail environmental degradation due to traffic.

UNIT- V

Highway Capacity And Level Of Service: Capacity and level of service; Factors affecting Capacity and LOS; Capacity of Rural Highways, Capacity of Urban Roads; HCM and IRC standards.

UNIT- VI

Intelligent Vehicle – Highway Systems: Traffic surveillance and monitoring; IVHS programs, Role of IVHS, IVHS categories, Benefits and Costs of IVHS.

Text Books:

1. 'Traffic Engineering: Theory and Practice' by Pignataro LJ., Prentice hall, Inc.
2. 'Traffic and Transport planning' by Kadiyali L.R., Khanna Publishers.

References:

1. 'Traffic Engineering Hand Book' by Institute of Transportation Engineers, 4 Ed., Prentice Hall.
2. 'Traffic Engineering' by Mc Shane, WR and RP Roess, Prentice Hall.

3. ‘Highway Traffic analysis and design’ by Salter RJ and NB Hounsell, 3rd ed., Macmillan.
4. ‘Traffic Planning and Engineering’ by Hobbs FD., Pergamon press.
5. ‘Traffic flow fundamentals’ by May, AD., Prentice Hall.

Web References:

1. http://nptel.ac.in/courses/105101008/12

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D07 - EARTHQUAKE RESISTANT DESIGN

(Elective –II)

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with Engineering Seismology.
- Equip student with concepts of Structural Dynamics.
- Understand Concepts of Seismic Design.
- Familiarize with Design philosophies for Seismic loading.
- Familiarize students with various IS codal provisions for ductile design and detailing.

Course Outcomes:

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

Course Outcomes	Description	Cognitive Level
CO1	Explain fundamentals of Engineering Seismology.	Comprehension
CO2	Acquaint with the principles Structural dynamics.	Knowledge
CO3	Solve SDOF Systems and suggest ductile design.	Applying
CO4	Compute equivalent lateral seismic loads and carryout a seismic design as per IS codal provisions.	Analyse
CO5	Seismic Analysis and design of simple 2-storied RC Building frame	Analyse
CO6	Understand about ductile detailing of flexural members as per IS 13920	Understand

SYLLABUS:

UNIT-I

Engineering seismology – rebound theory – plate tectonics – seismic waves - Earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects.

UNIT-II

Introduction to Structural Dynamics: Fundamental objective of Dynamic analysis – Types of prescribed loadings – Formulation of the Equations of Motion– Elements of a Vibratory system – Degrees of Freedom - Oscillatory motion – Simple Harmonic Motion – Free Vibrations of Single Degree of Freedom (SDOF) systems – Undamped and Damped –

Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor.

UNIT-III

Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames (MRF) – ductility of MRF – Infill wall – Non-structural elements.

UNIT-IV

Calculation of equivalent lateral force- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic weight- Response reduction factors- Seismic Coefficient Method.

UNIT-V

Design and ductile detailing of Beams and columns of frames -Concept of strong column weak beams, Ductility criteria for earthquake resistant design, Ductile detailing of flexural members as per IS 13920- Longitudinal reinforcement, Shear reinforcement, Anchorage of reinforcement-Development length, Lap Splices.

UNIT-VI

Seismic Analysis and design: simple 2-storied RC Building frame – Equivalent static lateral force method and response spectrum method.

Text Book:

1. 'Earthquake Resistant Design of Structures' -Pankaj Agarwal and Manish ShriKhande, Prentice – Hall of India, 2007, New Delhi.
2. 'Earthquake Resistant Design of Building Structures' by VinodHosur, Wiley India Ltd.
3. 'Reinforced Concrete Design' by A. K. Jain.

References:

1. 'Introduction to the Theory of Seismology' by Bullen K.E., Great Britain at the University Printing houses, Cambridge University Press 1996.
2. Relevant code of practices

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D08 - ADVANCED FOUNDATION ENGINEERING

(Elective –II)

Course Learning Objectives:

The objective of this course is:

- To enable the student to appreciate how Meyerhof's general bearing capacity equations are important over Terzaghi's bearing capacity equation.
- To teach the student special methods of computation of settlements and the corrections to be applied to settlements.
- To enable the student to understand the advanced concepts of design of pile foundations.
- To teach the student the problems posed by expansive soils and the foundation practices appropriate to expansive soils.
- To enable the student to learn the difference between isolated and combined footings, the determination of bearing capacity of mats and proportioning of footings.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Understand the advanced methods of settlement computations and proportion foundation footings.	Creating
CO2	Appreciate the methods of computing the pull-out capacity and negative skin friction of piles and compute the settlements of pile groups in clays.	Understanding
CO3	Appreciate the problems posed by expansive soils and the foundations practices devised.	Understanding
CO4	Appreciate the difference between isolated footings and combined footings and mat foundations.	Knowledge
CO5	Compute the safe bearing capacity of footings subjected to vertical and inclined loads.	Applying
CO6	Analyse the lateral stability of pile and well foundations.	Analyse

SYLLABUS:

UNIT-I

Bearing Capacity of Foundations: General bearing capacity equation –Meyerhof's, Brinch Hansen's and Vesic's methods.

UNIT-II

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

Mat Foundations– 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

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

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– Brom's analysis.

UNIT-VI

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.

Text Books:

1. 'Basic and applied soil mechanics' by GopalRanjan and ASR Rao, New Age Publishers. Civil Engineering 199

2. 'Soil Mechanics and Foundation Engineering' by VNS Murthy, CBS Publishers.

3. 'Principles of Foundation Engineering' by BM Das, Thomson Brooks/Cole.

Reference Books:

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

Mr.B R N Murthy

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IV Year-I Semester **L T P C**

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16CE7D09 - ADVANCED STRUCTURAL ENGINEERING

(Elective –II)

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with Raft Foundations and Retaining walls.
- Equip student with concepts of design of different types of RCC water tanks.
- Understand Concepts of flat slabs.
- Familiarize different types of Bunkers, Silos and Chimneys.
- Understand different types of transmission towers.
- Understand the efficiency of counter- fort retaining walls with gravity retaining walls.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Design raft foundations and different types of RCC retaining walls.	Create
CO2	Carryout analysis and design of different types of RCC water tanks.	Analyse
CO3	Carryout analysis and Design of Flat Slabs.	Analyse
CO4	Solve the problems design of RCC Bunkers, Silos.	Create
CO5	Solve the problems design of Chimneys.	Create
CO6	Understand various types of transmission towers.	Understand

SYLLABUS:

UNIT-I

Analysis and Design of Raft Foundations – Design of RCC Retaining walls: Cantilever and Counter fort.

UNIT–II

Analysis and Design of RCC Water Tanks: Circular and Rectangular types- Intze tank including staging.

UNIT–III

Analysis and Design of Flat Slabs- Direct Design and Equivalent Frame Methods- Check for Punching shear.

UNIT- IV

Analysis and Design of Bunkers and Silos: Concepts of Loading.

UNIT-V

Analysis and Design of Chimney, Concepts of loading.

UNIT-VI

Introduction to Steel Transmission Towers - Principles and procedures.

Text Books:

1. 'Reinforced Concrete Structures' Vol-2 by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
2. 'Reinforced Concrete Structures' by N. Subrahmanian, Oxford Publishers.
3. 'Design Drawing of Concrete and Steel Structures' by N. Krishna Raju University Press 2005.

References:

1. 'Essentials of Bridge Engineering' by D. Johnson Victor, Oxford and IBM publication Co., Pvt. Ltd.
2. 'Reinforced concrete design' by S. U, Pillai and D. Menon, Tata Mc.Grawhill Publishing Company
3. Codes: Relevant IS: codes.

INTERNAL EXAMINATION PATTERN:

The total internal marks (40) are distributed in two components as follows:

1. Descriptive (subjective type) examination: 30 marks
2. Assignment : 10 marks

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

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IV Year-I Semester **L T P C**

3 1 0 3

16CE7D10 - PAVEMENT ANALYSIS & DESIGN

(Elective –II)

Course Learning Objectives:

The objective of this course is:

- To know various factors affecting pavement design.
- To know various concepts for the stresses in pavements.
- To understand material characterization and mix design concepts.
- To acquire design principles of flexible and rigid pavements.
- To acquire design principles of shoulders, overlays and drainage.
- To know various traffic control devices and principles of highway safety.
- To understand the detrimental effects of traffic on environment.
- To know highway capacity and level of service concepts.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Know the factors affecting the pavement design.	Knowledge
CO2	Determine the stresses under the wheel loads.	Evaluation
CO3	Know the concepts of material characterisation & mix design.	Knowledge
CO4	Designof flexible pavements.	Create
CO5	Design of rigid pavements.	Create
CO6	Design Of Shoulders, Overlays & Drainage	Create

SYLLABUS:

UNIT-I

Factors Affecting Pavement Design: Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT,

AADT, Truck Factor, Growth Factor, Lane, Directional Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.

UNIT-II

Stresses In Pavements: Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements; Stress in Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts; Stresses in Rigid Pavements:Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, Stresses in Dowel Bars & Tie Bars, Introduction to DAMA, KENLAYER & KENSLABS Programs.

UNIT-III

Material Characterisation & Mix Design Concepts: CBR and Modulus of Subgrade Reaction of Soil, Mineral aggregates – Blending of aggregates, binders, polymer and rubber modified bitumen, Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties, Effects and Methods of Stabilisation and Use of Geo Synthetics; Marshall's and Hveem's Methods of Bituminous Concrete Mix Design, Field Implications of Stability and Flow Values, Introduction to Super Pave Mix Design, IRC Cement Concrete Mix Design.

UNIT-IV

Design of Flexible Pavements: Flexible Pavement Design Concepts, Asphalt Institute's Methods with HMA and other Base Combinations, AASHTO, Road Note No 29 & IRC Methods, Design of Runways & Taxiways, Design of Low Volume Rural Roads. Serviceability Concepts, Visual Rating, Pavement Serviceability Index

UNIT-V

Design Of Rigid Pavements: Calibrated Mechanistic Design Process, PCA, AASHTO & IRC Specifications, Introduction to Prestressed and Continuously Reinforced Cement Concrete Pavement Design, Rigid Pavement Design for Low Volume Rural Roads.

UNIT-VI

Design Of Shoulders, Overlays & Drainage: Shoulder Design Considerations, Traffic Prediction, Parking, Regular & Encroaching Traffic, Thickness Design Specifications for Flexible & Rigid Shoulders; Types & Design of Overlays: AI's Principal Component Analysis & IRC Methods of Overlay Design, Importance of Profile Correction Course;

Pavement Drainage Concepts, Drainage Related Failures, Inflow-Outflow Concepts, Condition of Continuity, Surface and Sub Surface Drainage Design Specifications.

Text Books:

1. 'Pavement Analysis and Design' by Yang H. Huang, Pearson Education, Second Edition.
2. 'Principles of Pavement Design' by Yoder.J. &Witczat Mathew, W. John Wiley & Sons Inc.
3. 'Pavement Design' by Srinivasa Kumar R, Universities Press, Hyderabad.
4. 'Traffic Engineering' by Mc Shane, WR and RP Roess, Prentice Hall.

References:

1. 'Design of Functional Pavements' by Nai C. Yang, McGraw Hill Publications.
2. 'Concrete Pavements' by AF Stock, Elsevier, Applied Science Publishers.
3. 'Pavement and Surfacing's for Highway & Airports' by MichealSargious, Applied Science Publishers Limited.
4. 'Dynamics of Pavement Structures' by G. Martineek, Chapmen & Hall Inc.
5. 'Principles of Transportation Engineering' by PathaChakroborty and Animesh Das, PHI Learning Private Limited, Delhi.
6. Traffic Engineering - Theory & Practice - Louis J. Pignataro, Prentice Hall Publication.

E-References:

- http://nptel.ac.in/syllabus/syllabus.php?subjectId=105105044
- http://nptel.ac.in/syllabus/syllabus.php?subjectId=105107064

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IV Year-I Semester

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16CE7D11 - GROUND WATER DEVELOPMENT

(Elective –II)

Course Learning Objectives:

The course is designed to

- Appreciate groundwater as an important natural resource.
- Understand flow towards wells in confined and unconfined aquifers.
- Understand the principles involved in design and construction of wells.
- Create awareness on improving the groundwater potential using various recharge techniques.
- Know the importance of saline water intrusion in coastal aquifers and its control measures.
- Appreciate various geophysical approaches for groundwater exploration.
- Learn groundwater management using advanced tools.
- Know the different types of aquifiers.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Estimate aquifer parameters and yield of wells.	Evaluate
CO2	Analyse radial flow towards wells in confined and unconfined aquifers.	Analysis
CO3	Design wells and understand the construction practices.	Create
CO4	Interpret geophysical exploration data for scientific source finding of aquifers.	Apply
CO5	Determine the process of artificial recharge for increasing groundwater potential.	Evaluation
CO6	Take effective measures for controlling saline water intrusion.	Understand

SYLLABUS:

UNIT – I

Introduction: Groundwater in the hydrologic cycle, groundwater occurrence, aquifer parameters and their determination, general groundwater flow equation. Well Hydraulics Steady radial flow and unsteady radial flow to a well in confined and unconfined aquifers, Theis solution, Jocob and Chow's methods, Leaky aquifers.

UNIT – II

Well Design: Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery.

UNIT III

Well Construction and Development: Water wells, drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open-hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.

UNIT IV

Artificial Recharge: Concept of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge.

Saline Water Intrusion: Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of interface, control of saline water intrusion.

UNIT – V

Geophysics: Surface methods of exploration of groundwater – Electrical resistivity and Seismic refraction methods, Sub-surface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications.

UNIT – VI

Groundwater Modelling and Management: Basic principles of groundwater modelling-Analog models-viscous fluid models and membrane models, digital models-Finite difference and finite element models, Concepts of groundwater management, basin management by conjunctive use-case studies.

Text Books:

1. 'Groundwater' by Raghunath H M, New Age International Publishers, 2005.
2. 'Groundwater Hydrology' by Todd D.K., Wiley India Pvt Ltd., 2014.
3. 'Groundwater Hydrology' by Todd D K and L W Mays, CBS Publications, 2005.

References:

1. ‘Groundwater Assessment and Management’ by Karanth K R, Tata McGraw Hill Publishing Co., 1987.
2. ‘Groundwater Hydrology’ by Bouwer H, McGraw Hill Book Company, 1978.
3. ‘Groundwater Systems Planning and Management’ by Willis R and W.W.G. Yeh, Prentice Hall Inc., 1986.
4. ‘Groundwater Resources Evaluation’ by Walton W C, McGraw Hill Book Company, 1978.

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IV Year-I Semester

L	T	P	C
3	1	0	3

16CE7D12 - ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT

(Elective –II)

Course Learning Objectives:

The objective of this course is:

- To impart knowledge on different concepts of Environmental Impact Assessment.
- To know procedures of risk assessment
- To learn the EIA methodologies and the criterion for selection of EIA methods.
- To pre-requisites for ISO 14001 certification
- To know the procedures for environmental clearances and audit
- To appreciate the importance of stakeholder participation in EIA

Course Learning Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Prepare EMP, EIS, and EIA report	Apply
CO2	Identify the risks and impacts of a project	Identify
CO3	Selection of an appropriate EIA methodology	Identify
CO4	Evaluation the EIA report	Evaluation
CO5	Estimate the cost benefit ratio of a project	Apply
CO6	Know the role of stakeholder and public hearing in the preparation of EIA	Knowledge

SYLLABUS:

UNIT – I

Basic concept of EIA: Elements of EIA-factors affecting EIA-Initial environmental Examination-life cycle analysis preparation of Environmental Base map-Classification of environmental parameters – role of stakeholders in the EIA preparation –stages in EIA.

UNIT – II

EIA Methodologies: introduction, Criteria for the selection of EIA Methodology, EIA methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis - EIS and EMP.

UNIT-III

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives-application of remote sensing and GIS for EIA.

UNIT-IV

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - EIA with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, generalized approach for assessment of Air pollution Impact.

UNIT – V

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation.Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment-advantages of Environmental Risk Assessment.

UNIT-VI

EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, procedure for environmental clearance, and procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, Evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Text Books:

- Environmental Impact Assessment, Canter Larry W.,McGraw-Hill education Edi (1996)
- Environmental Impact Assessment Methodologies, by Y.Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad.

References:

- Environmental Science and Engineering, by J. Glynn and Gary W.HeinKe – Prentice Hall Publishers.
- Environmental Science and Engineering, by Suresh K. Dhaneja – S.K. Katania& Sons Publication, New Delhi.
- Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd., Delhi.

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IV Year-I Semester **L T P C**

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16CE7L10 - IRRIGATION DRAWING & CAED PRACTICE

Course Objectives:

The objective of this course is:

- To enhance the students knowledge and skills in Irrigation drawing.
- To introduce computer aided drafting packages and commands for modelling and sketching.
- To learn surface modelling techniques required designing and machining
- To draw the geometric entities and create 2D and 3D wire frame models.
- To learn various modelling techniques such as edit, zoom, cross hatching, pattern filling, rotation, etc.

Course outcomes:

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

Course outcome	Description	Cognitive level
CO1	Able to know all the design of irrigation structures	Create
CO2	Design the surplus weir, canal regular	Create
CO3	Plotting the irrigation structures to CAD	Apply
CO4	Basically idea about all Irrigation structural components.	Knowledge
CO5	Generate assembly of various components of compound solids.	Understand
CO6	Develop the components using 2D and 3D wire frame models through various editing commands.	Apply

SYLLABUS:

UNIT-I

SURPLUS WEIR:

Introduction, Estimation of flood discharge, Design, The effect of Absorption capacity on the design of the waste weirs. Detailing of Surplus weir design on sheet.

UNIT-II

TANK SLUICE WITH TOWER HEAD:

Design, Ayacut, vent-way, sluice barriel, R.C.slab, side walls, Earth pressure, weight transmitted by the Roof slab, Weight of Earth on the Top side of wall Beyond the slab, Weight of Earth standing on the slope of side wall, weight of masonry side wall, stability analysis, Tower Head, Checking the thickness of well at +36.50; checking thickness of well at +34.00; Cistern in Rear of the Barrel, Specifications. Detailing of design of Tank sluice with Tower head on sheet.

UNIT-III

DIRECT SLUICE:

Hydraulic particulars of Main Canal; Hydraulic particulars of the Dis- tributary; sluice vent-way; Design of Sluice Barriel; section across the sluice Barrel; Design of Roof slab; Design of head walls, Wing walls on the upstream side; Return wall; Specifications. Detailing of design of Direct Sluice on Sheet.

PART- B COMPUTER AIDED DRAFTING

UNIT- IV

Introduction To Computer Aided Drafting: Generation of points, lines, curves, polygons, dimensioning. Types of modelling: object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modelling, and 3D wire frame modelling.

UNIT -V

Objective: By going through this topic the student will be able to understand the paper-space environment thoroughly. View Points and View Ports: view point coordinates and view(s) displayed, examples to exercise different options like save restore, delete, joint, single option.

UNIT -VI

Computer Aided Solid Modelling: Isometric projections, orthographic projections of isometric projections, modelling of simple solids, Modelling of Machines & Machine Parts.

Text Book:

- A text book Water Resources Engineering (principles and practice) by SatyaNarayanaMurtyChalla by New Age International publishers.

References:

- Mastering Auto CAD 2017 and Auto CAD LT 2017 – George Omura, Sybex.
- Auto CAD 2017 fundamentals- Elisemoss, SDC Publ.
- Engineering Drawing and Graphics using Auto Cad–T Jeyapoovan, vikas.

- Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age.
- Text book of Engineering Drawing with auto-CAD, K.Venkata Reddy/B.S . Publications.

Internal Evaluation: Max. Marks: 40

The total internal evaluation marks are distributed in following two components:

- Day-to-day work : 20 marks
- Internal test : 20 marks
- I Mid (Internal Test 1) Examination Part A - Irrigation drawing Exam
- II Mid (Internal Test 2) Examination Part B - In Computer Lab

Note: The duration of the internal test is 2 hours and it must be conducted as per the schedules notified. End Semester Examination (Total Duration: 4 Hours, Max. Marks: 60)

PART A – Irrigation drawing pattern (Duration: 3 Hours, Marks: 30)

PART B – Computer lab pattern using any drafting packages (Duration: 2 Hours, Marks: 30)

(Note: both PART A and PART B are compulsory and are to be conducted in separate sessions)

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IV Year-I Semester

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16CE7L11 - GIS & CAD LAB

Course Learning Objectives:

The course is designed to**:**

- Introduce image processing and GIS software.
- Familiarize structural analysis software.
- Understand the process of digitization, creation of thematic map from toposheets and maps.
- Learn to apply GIS software to simple problems in water resources and transportation engineering.
- Learn to analyse 2 D and 3D frame steel tubular truss using structural analysis software.
- Learn to analyse and design retaining wall and simple towers.

Course outcomes:

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

Course Outcome	Description	Cognitive level
CO1	Compile a rectification/ geo-referencing of scanned images by assigning latitudes and longitudes or x,y coordinates.	Create
CO2	Digitize, create and classification of thematic map.	Create
CO3	Discriminate between special and non-spatial data	Understand
CO4	Develop digital elevation model.	Create
CO5	Use structural analysis software to analyse and design 2D and 3D frames	Analyse
CO6	Design and analyse retaining wall and simple towers using CAD software.	Analyse

GIS SOFTWARES:

- Arc GIS 9.0
- ERDAS 8.7
- MapInfo 6.5
- Any one or Equivalent.

Excercises in GIS:

1. Digitization of Map/Toposheet.
2. Creation of thematic maps.
3. Estimation of features and interpretation.
4. Developing Digital Elevation model.
5. Simple applications of GIS in water Resources Engineering & Transportation Engineering.

COMPUTER AIDED DESIGN AND DRAWING SOFTWARE:

1. STAAD PRO / Equivalent
2. STRAP
3. STRUDS

Excercisies:

1. 2-D Frame Analysis and Design
2. Steel Tabular Truss Analysis and Design
3. 3-D Frame Analysis and Design
4. Retaining Wall Analysis and Design
5. Simple Tower Analysis and Design

TEXT BOOK:

1. 'Concept and Techniques of GIS' by C.P.L.O. Albert, K.W. Yong, Printice Hall Publishers.

IV Year-II Semester

L	T	P	C
3	1	0	3

16CE8T23 - CONSTRUCTION TECHNOLOGY & MANAGEMENT

Course Learning Objectives:

The objective of this course is:

- To introduce to the student the concept of project management including network drawing and monitoring.
- To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery.
- To introduce the importance of safety in construction projects.
- To introduce the importance of Man power in Construction projects.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Apply the project management techniques for construction planning	Application
CO2	Apply the project management for Solve and upgrade the PERT Technique by using resources in construction	Application
CO3	Plan the suitable equipment's in various tasks of civil engineering projects.	Synthesis
CO4	Apply the safety requirements and quality control aspects in projects	Application
CO5	Understand the planning of Man power in contruction projects in suitable tasks	Understand
CO6	Plan the suitable construction methods for the site execution.	Synthesis

SYLLABUS:

UNIT- I

Construction Project Management and its Relevance– qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method.

UNIT -II

Project Evaluation and Review Technique– cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources.

UNIT- III

Construction Equipment– economical considerations – earthwork equipment– Trucks and handling equipment – rear dump trucks – capacities of trucks. Handling equipment – calculation of truck production – compaction equipment – types of compaction rollers.

UNIT -IV

Hoisting and Earthwork Equipment– hoists – cranes – tractors - bulldozers – graders – scrapers– draglines -clamshell buckets.

UNIT -V

Concreting Equipment– crushers – jaw crushers – rotary crushers – impact crushers – selection of crushing equipment - screening of aggregate – concrete mixers – mixing and placing of concrete – consolidating and finishing.

UNIT -VI

Construction Methods– earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. Man power planning in construction projects.

Text Books:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata M c Graw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha (2011), Pearson.
3. 'Construction Technology' by Subir K. Sarkar and SubhajitSaraswati, Oxford University press.
4. Construction project management By K. K CHITKARA,Tata M c Graw hill.

References:

1. ‘Construction Project Management - An Integrated Approach’ by Peter Fewings, Taylor and Francis.
2. ‘Construciton Management Emerging Trends and Technologies’ by Trefor Williams, Cengage learning.
3. Construction planning and management By P S GHALOT and B M DHIR

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IV Year-II Semester **L T P C**

3 1 0 3

16CE8T24 - ESTIMATING, SPECIFICATIONS & CONTRACTS

Course Learning Objectives:

The objective of this course is to enable the students to:

- Understand the quantity calculations of different components of the buildings.
- Understand the rate analysis of different quantities of the buildings components.
- Learn various specifications and components of the buildings.
- To study estimation of buildings including R.C.C. members.
- To study rate analysis.
- To bring about an exposure to field problems associated with roads/bridge marking and estimation of roadwork quantities.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Determine the quantities of different components ofbuildings.	Applying
CO2	Analyse of civil engineering projects along with quantities.	Analysing
CO3	Estimate the value of existing infrastructure.	Analysing
CO4	Knowledge on methods of valuation and forestimating cost depreciations & types of contractsand tenders.	Knowledge
CO5	Identify, analyse and solving problems on estimation of buildings.	Analysing
CO6	Estimate the cost of various building components.	Applying

SYLLABUS:

UNIT – I

General items of work in Building Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT – II

Rate Analysis – Working out data for various items of work over head and contingent charges.

UNIT-III

Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules. Detailed Estimation of Public Structures like Bridges, water tanks and soak pits, septic tanks.

UNIT – IV

Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings- Standard specifications for different items of building construction.

UNIT-V

Detailed Estimation of Buildings using individual wall method.

UNIT –VI

Detailed Estimation of Buildings using centre line method.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of SIX questions from Unit 1 to Unit 4, out of which THREE are to be answered (60% weight-age) & ONE mandatory question (40% weight-age) from Units 5 & 6 is to be answered.

Text Books:

1. 'Estimating and Costing' by B.N. Dutta, UBS publishers,2000.
2. 'Civil Engineering Contracts and Estimates' by B. S. Patil, Universities Press (India) Pvt. Ltd.,Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. NewDelhi.
4. 'Estimating and Costing' by G.S.Birdie.

References:

1. ‘Standard Schedule of rates and standard data book’ by public works department.
2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works –B.I.S.)
3. ‘Estimation, Costing and Specifications’ by M. Chakraborthi; Laxmi publications.
4. National BuildingCode.

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IV Year-II Semester **L T P C**

3 1 0 3

16CE8T25 - PRESTRESSED CONCRETE

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with concepts of prestressing.
- Equip student with different systems and devices used in prestressing.
- Understand the different losses of prestress including short and long term losses.
- Familiarize students with the analysis and design of prestressed concrete members under flexure, shear and torsion.
- To be able to understand the major difference between R.C.C Design and P.S.C.Design

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Perceive the different methods of prestressing.	Understand
CO2	Analyze and design prestressed concrete beams under flexure and shear Resistance.	Analyse
CO3	Understand the various losses in prestressed concrete systems.	Understand
CO4	Evaluate the effective prestress including the short and long term losses.	Evaluation
CO5	Understand the relevant IS Codal provisions for prestressed concrete	Understand
CO6	Understand the Anchorage Zone reinforcement.	Understand

SYLLABUS:

Unit – I

Introduction: Historic development – General principles of prestressing, pretensioning and post tensioning – Advantages and limitations of prestressed concrete – Materials – High strength concrete and high tensile steel their characteristics. I.S.Code provisions, Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of post

tensioning - Different systems of prestressing like Hoyer System, Magnel System Freyssinet system and Gifford – Udall System.

Unit – II

Analysis of Sections for Flexure: Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons. Concept of load balancing method, pressure line (Trust), Cracking moment for mid and end support conditions.

Unit III

Losses of Prestress:Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage bending of member and frictional losses.

UNIT-IV

Design for flexural resistance: Design for Flexural resistance- Types of flexural failure – Code procedures-Design of sections for flexure- Control of deflections- Factors influencing-Prediction of short term and long term deflections.

UNIT-V

Design for Shear and Torsion- Shear and Principal Stresses: Design of Shear reinforcements-Codal Provisions- Design for Torsion, Design for Combined bending, shear and torsion.

UNIT-VI

Transfer of Prestress in pre tensioned members- Transmission length- Bond stresses- End zone reinforcement- Codal provisions- Anchorage zone stresses in Post tensioned members-Stress distribution in End block- Anchorage Zone reinforcement.

TEXT BOOKS:

1. 'Prestressed Concrete' by N. Krishna Raju, Tata McGraw hill.
2. 'Prestressed Concrete' by S. Ramamrutham.

REFERENCES:

1. 'Prestressed Concrete' by P. Dayaratnam.
2. 'Prestressed Concrete' by T. Y. Lin & Burns, Wiley Publications.

E-References:

1. http://freevideolectures.com/Course/94/Prestressed-Concrete-Structures

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IV Year-II Semester

L	T	P	C
3	1	0	3

16CE8D13 - SOIL DYNAMICS & MACHINE FOUNDATION
(Elective – 3)

Course Learning Objectives:

This course on 'Soil Dynamics' discusses:

- About the fundamentals of vibrations.
- About the behaviour and properties/response of soil as a material which is subjected to various types of dynamic or cyclic time dependent loadings.
- The design and analysis for machine foundations.
- Discusses about the laboratory and filed tests to compute the dynamic soil properties of the soil mass.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Understand the dynamic behaviour of foundation.	Understand
CO2	Conduct laboratories and field tests to collect dynamic soil prosperities and its interpretation.	Applying
CO3	Design the machine foundations based on the loads and soil conditions.	Creating
CO4	Understand the behaviour of soil under dynamic loading using theory of vibrations	Evaluating
CO5	Draw free body diagrams of machine foundations.	Knowledge
CO6	Design the vibration isolators and vibration machines.	Create

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.

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. 'Analysis and design of Foundations for Vibrations' by P J Moore.
4. 'Fundamentals of Soil Dynamics' by B M Das.
5. 'Dynamics of bases and Foundations' by D DBarkan.

Web Reference:

1. http://www.nptelvideos.in/2012/11/soil-dynamic.html

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IV Year-II Semester

L	T	P	C
3	1	0	3

16CE8D14 - SOLID AND HAZARDOUS WASTE MANAGEMENT
(Elective – 3)

Course Learning Objectives:

The objective of this course is:

- To impart the knowledge the methods of collection and optimization of collection routing of municipal solid waste.
- To acquire the principles of treatment of municipal solid waste.
- To know the impact of solid waste on the health of the living beings.
- To learn the criterion for selection of landfill and its design.
- To plan the methods of processing such as composting the municipal organic waste.

Course Learning Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Design the collection system of a solid waste of a town.	Creating
CO2	Analysis and handling of solid waste collection.	Analysis
CO3	Know the criteria for selection of landfill	Knowledge
CO4	Characterise the solid waste and design a composting facility	Evaluating
CO5	Understand the processing and treatment of solid waste	Understand
CO6	Appraise the current practices available and methods of handling sampling and disposal of solid waste.	Apply

SYLLABUS:

UNIT- I

Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste – sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT- II

Basic Elements In Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste Collection of Solid Waste: Type and methods of waste collection systems, analysis of

collection system – optimization of collection routes– alternative techniques for collection system.

UNIT- III

Transfer and Transport: Need for transfer operation, compaction of solid waste – transport means and methods, transfer station types and design requirements.

UNIT- IV

Separation and Transformation of Solid Waste: unit operations used for separation and transformation: shredding – materials separation and recovery, source reduction and waste minimization.

UNIT- V

Processing and Treatment: Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT- VI

Disposal of Solid Waste: Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

TEXT BOOKS:

1. George Techobanoglous "Integrated Solid Waste Management", McGraw Hill Publication, 1993

REFERENCES:

1. Vesilind, P.A., Worrell, W., Reinhart, D. "Solid Waste Engineering", Cenage learning, New Delhi, 2004
2. Charles A. Wentz; "Hazardous Waste Management", McGraw Hill Publication, 1995.

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IV Year-II Semester

L	T	P	C
3	1	0	3

16CE8D15 - BRIDGE ENGINEERING
(Elective – 3)

Course Learning Objectives:

The objective of this course is:

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

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Know about Bridges with diagrams and Loading standards.	Apply
CO2	Design of Slab bridges and suggest structural detailing.	Create
CO3	Design of Plate girder bridges.	Create
CO4	Organize for attending inspections and maintenance of bridges and prepare reports.	Evaluation
CO5	Design of box culverts and suggest structural detailing.	Create
CO6	Design of T beam bridge.	Create

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- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading.

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 – Massonet Method –Hendry- Jaegar Methods- Courbon's theory- Pigeaud's method.

UNIT-III

T-Beam bridges- Analysis and design of various elements of bridge –Design of deck slab, longitudinal girders, and Secondary beams- Reinforcement detailing.

UNIT-IV

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

UNIT-V

Box Culverts: Loading –Analysis and Design- Reinforcement detailing.

UNIT-VI

Inspection and Maintenance of Bridges: Procedures and methods for inspection – Testing of bridges- Maintenance of Sub Structures and Superstructures- Maintenance of bearings- Maintenance Schedules.

INTERNAL EXAMINATION PATTERN:

The total internal marks (40) are distributed in two components as follows:

1. Descriptive (subjective type) examination: 30marks
2. Assignment: 10 marks

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Text Book:

1. 'Essentials of Bridge Engineering' by Jhonson Victor D.
2. 'Design of Bridge Structures' by T. R. Jagadeesh, M.A. Jayaram, PHI.
3. 'Design of RC Structures' by B. C. Punmai, Jain & Jain, Lakshmi Publications.

References:

1. ‘Design of Concrete Bridges’ by Aswini, Vazirani, Ratwani.
2. ‘Design of Steel Structures’ by B. C. Punmai, Jain & Jain, Lakshmi Publications.
3. ‘Design of Bridges’ by Krishna Raju.

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IV Year-II Semester

L	T	P	C
3	1	0	3

16CE8D16 - WATER RESOURCE SYSTEM PLANNING
(Elective – 3)

Course Learning Objectives:

The course is designed to:

- Introduce the concepts of system analysis in the planning, design, and operation of water resources.
- Appreciate mathematical optimization methods and models.
- Learn and apply basic economic analysis tools to water resources projects.
- Understand linear, nonlinear and dynamic programming techniques and apply them to various water resources systems planning and design problems.
- Appreciate simulation and management techniques in water resources systems.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Apply optimization methods related to water resource systems.	Apply
CO2	application of linear programming in water resources	Apply
CO3	Formulate optimization models for decision making in water resources systems.	Apply
CO4	Simulate models for planning and design of Water Resources Systems.	Analysis
CO5	Understand the Non- Linear Optimization Techniques in water resources.	Understand
CO6	Perform basic economic analysis to evaluate the economic feasibility of water resources projects.	Evaluation

SYALLABUS

UNIT-I

Introduction: concepts of systems analysis, definition. Systems approach to water resource planning, role of optimization models, objective function and constraints, types of optimization techniques.

UNIT- II

Linear Programming: Formation of linear programming models, graphical methods, simplex method, application of linear programming in water resources.

UNIT-III

Linear Programming: Revised simplex method, duality in linear programming, sensitivity and past optimality analysis.

UNIT-IV

Dynamic Programming:principles of optimality forward and backward recursive dynamic programming, case of dimensionality, application for resource allocation.

UNIT-V

Non- Linear Optimization Techniques: Critical method of optimization, Kuch – Tucleer, gradential based research techniques for simple unconstrained optimization.

UNIT-VI

i) Simulation: Application of simulation techniques in water resources.

ii) Water Resource Economics: Principles of Economic analysis benefit – cost analysis socio economic intuitional pricing of water resources.

TEXT BOOKS:

1. Water resource system analysis – Vedula&Mujumdar – Tata Mc. Graw hill company Ltd. 2005.
2. Water resources Economics – James & Lee. Oxford publishers 2005.

REFERENCE BOOK:

1. Optimal design of water distribution networks P.R.Bhave, Narosi publishing house 2003.

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IV Year-II Semester

L	T	P	C
3	1	0	3

16CE8D17 - TRANSPORTATION PLANNING ENGINEERING
(Elective – 3)

Course Learning Objectives:

The objective of this course is:

- To learn various procedures for travel demand estimation.
- To various data collection techniques for OD data.
- To know various models and techniques for trip generation, trip distribution, mode choice and traffic assignment.
- To develop alternative urban transport network plans.

Course Outcomes:

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

Course outcome	Description	Cognitive level
CO1	Evaluate various alternative transportation proposals.	Analysing
CO2	Identify the corridor and plan for providing good transportation facilities.	Remembering
CO3	Describe the fundamental parameters and relationships that characterize the operation of a transportation facility.	Analysing
CO4	Describe methods of monitoring, assessing and improving the performance of transportation facilities.	Analysing
CO5	Estimate the demand for a transportation facility using the four-step planning process.	Analysing
CO6	Apply queuing models to evaluate the performance of a transportation system.	Applying

SYLLABUS:

UNIT –I

Urban Transportation Problems & Travel Demand: Urban Issues, TravelCharacteristics, 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.

UNIT –II

Data Collection And Inventories: Collection of data – Organisation 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.

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.

UNIT –IV

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. Economic evaluation techniques – Road user cost, Net present value method, Benefit cost ratio method, internal rate of return method, comparison of various methods

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

Text Books:

1. 'Introduction to Urban System Planning' by Hutchinson, B.G., McGraw Hill.
2. 'Transportation Engineering - An Introduction' by Khisty C.J., Prentice Hall.
3. 'Fundamentals of Transportation Planning' by Papacostas, Tata McGraw Hill.

References:

1. 'Urban Transportation Planning: A decision oriented Approach' by Mayer M and Miller E, McGraw Hill.
2. 'Introduction to Transportation Planning' by Bruton M.J., Hutchinson of London.
3. 'Metropolitan Transportation Planning' by Dicky, J.W., Tata McGraw Hill.
4. 'Traffic Engineering and Transportation Planning' by Kadiyali.L.R., Khanna Publishers, New Delhi
5. Lecture notes on UTP - Prof. S. Raghavachari ,R.E.C.Warangal.

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