



# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

AN AUTONOMOUS INSTITUTION

Accredited by NBA and NAAC with A+ Grade

(Sponsored by TKR Educational Society, Approved by AICTE, Affiliated to JNTUH)

Medbowli, Meerpet, Balapur, Hyderabad, Telangana – 500097



## B.TECH CIVIL ENGINEERING – R22

### SEMESTER V

S. No	Course Class	Course Code	Name of the Subject	L	T	P	C	I	E	Total
1.	PC	D15PC15	Water Resources Engineering-I	3	0	0	3.0	40	60	100
2.	PC	D15PC16	Design of Reinforced Concrete Structures	3	1	0	4.0	40	60	100
3.	PC	D15PC17	Structural Analysis-I	3	0	0	3.0	40	60	100
4.	PE1	D15PE1	Transportation Engineering	3	0	0	3.0	40	60	100
			Construction Equipment & Materials							
			Railway Engineering							
5.	PE2	D15PE2	Infrastructure Planning and Management	3	0	0	3.0	40	60	100
			Remote Sensing & Geographic Information System							
			Solid and Hazardous Waste Management							
6.	PC	D15PC18	Hydraulics & Hydraulic Machinery Lab	0	0	2	1.0	40	60	100
7.	HS	D5HSE3	Advanced English Communication Skills Lab	0	0	4	2.0	40	60	100
8.	ES	D15ESCA2	Computer Aided Detailed Drawing Lab	0	0	2	1.0	40	60	100
9.	MC		Constitution of India*	3	0	0	0	0	0	S
<b>Total</b>				<b>18</b>	<b>1</b>	<b>6</b>	<b>20.0</b>	<b>320</b>	<b>480</b>	<b>800</b>
<b>Mandatory Course: Constitution of India</b>										

### SEMESTER VI

S. No	Course Class	Course Code	Name of the Subject	L	T	P	C	I	E	Total
1.	PC	D16PC19	Soil Mechanics	3	0	0	3.0	40	60	100
2.	PC	D16PC20	Environmental Engineering	3	0	0	3.0	40	60	100
3.	PC	D16PC21	Design of Steel Structures	3	0	0	3.0	40	60	100
4.	PC	D16PC22	Structural Analysis-II	3	0	0	3.0	40	60	100
5.	PE3	D16PE3	Water Resources Engineering-II	3	0	0	3.0	40	60	100
			Ground Improvement Techniques							
			Bridge Engineering							
6.	HS	D6HSBF	Business Economics and Financial Analysis	3	0	0	3.0	40	60	100
7.	PC	D16PC23	Soil Mechanics Lab	0	0	2	1.0	40	60	100
8.	ES	D16ESGL	Geographic Information System Lab	0	0	2	1.0	40	60	100
<b>Total</b>				<b>17</b>	<b>0</b>	<b>4</b>	<b>20.0</b>	<b>320</b>	<b>480</b>	<b>800</b>

L - Lecture Hours / Week; T - Tutorial Hours / Week; P - Practical Hours / Week;  
I - Internal Marks; E - External Marks; S – Satisfactory



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## WATER RESOURCES ENGINEERING-I - D15PC15

V Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITES:** A preliminary background in Fluid Mechanics is desired.

**COURSE OBJECTIVES:** The objective of this course is to,

1. Understand engineering hydrology and its applications like Runoff estimation, estimation of design discharge and flood routing.
2. Understand irrigation engineering structures - Water utilization for crop growth and their designs.

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

1. Analyze hydro-meteorological data.
2. Estimate abstractions from precipitation.
3. Compute yield from surface and subsurface basins.
4. Develop rainfall-runoff models.
5. Formulate and solve hydrologic flood routing models.

### UNIT-I: HYDROLOGY

Introduction to Engineering Hydrology and its applications, Hydrologic cycle, types and forms of precipitation, rainfall measurement, types of rain gauges, computation of average rainfall over a basin, processing of rainfall data - Adjustment of record - Rainfall Double Mass Curve. Runoff - Factors affecting Runoff - Runoff over a Catchment - Empirical and Rational Formulae.

Abstraction from rainfall - Evaporation, factors affecting evaporation, measurement of evaporation – Evapo-transpiration - Penman and Blaney & Criddle Methods - Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices.

### UNIT-II: RUNOFF

Distribution of Runoff - Hydrograph Analysis Flood Hydrograph - Effective Rainfall - Base Flow - Base Flow Separation - Direct Runoff Hydrograph Unit pulse and Unit step function - Unit Hydrograph, definition, limitations and applications of Unit hydrograph, derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa - S-hydrograph, Synthetic Unit Hydrograph.

### UNIT-III: WELL IRRIGATION

Ground water Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, Darcy's law, radial flow to wells in confined and unconfined aquifers. Types of wells - Well Construction - Well Development.

### UNIT-IV: IRRIGATION ENGINEERING

Necessity and Importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, Indian agricultural soils, methods of improving soil fertility - Crop Rotation, preparation of land for Irrigation, standards of quality for Irrigation water.



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Soil-water-plant relationship, vertical distribution of soil moisture, soil moisture constants, soil moisture tension, consumptive use, Duty and delta, factors affecting duty - Design discharge for a water course. Depth and frequency of Irrigation, irrigation efficiencies - Water Logging.

## UNIT-V: CANAL DESIGN

Classification of canals, Design of Irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting, IS standards for a canal design canal lining. Design Discharge over a catchment, Computation of design discharge-rational formulae etc.

### TEXT BOOKS:

1. Engineering Hydrology by K. Subramanya Mc-Graw Hill Pvt. Ltd.
2. Engineering Hydrology by Jayarami Reddy, Laxmi Publications Pvt. Ltd., New Delhi.
3. Irrigation and Water Resources & Water Power by P. N. Modi, Standard Book House.

### REFERENCE BOOKS:

1. Engineering Hydrology by CSP Ojha, R. Berndtsson and P. Bhunya, Oxford University Press.
2. Irrigation and Water Power Engineering by Punmia & Lal, Laxmi publications Pvt. Ltd., New Delhi.
3. Applied hydrology by V.T. Chow, D.R. Maidment and L.W. Mays, Mc-Graw Hill Pvt Ltd.
4. Hydrology in Practice by E. M. Shaw, K. J. Beven, CRC Press.



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## DESIGN OF REINFORCED CONCRETE STRUCTURES - D15PC16

V Semester

L/T/P/C

3/1/0/4

**PRE-REQUISITES:** Strength of Materials, Structural Analysis.

**COURSE OBJECTIVES:** The objective of this course is to

1. To study the stress strain behavior of reinforced steel and concrete.
2. To understand the concept of working stress and limit state methods.
3. To gain the knowledge of limit state design of various structural elements in flexure, Compression, shear, bond and anchorage.
4. To understand the design concept of various structural elements and detailing of Reinforcement

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

1. Design the Reinforced Concrete L and T beam sections using Limit State Design.
2. Design of Reinforced Concrete Canopy and Simply Supported, Continuous Beams.
3. Design the Reinforced Concrete Columns.
4. Design of One way, two way Slab and Continuous Slab.
5. Design Footings: Isolated, Square, Rectangular and Circular, Combined.

### UNIT-I

Concepts of RC Design - Working Stress Method - Limit State Method - Material Stress - Strain Curves - Safety factors - Characteristic Strength and Load. Stress Block Parameters - IS 456. Beams: Limit State Analysis and Design of Singly Reinforced, Doubly Reinforced, Flanged beams - Sketch Showing Reinforcement Details.

### UNIT-II

Limit State Analysis and Design of Section for Shear and Torsion - Concept of Bond, Anchorage and Development Length, I.S. Code Provisions. Design Examples in Simply Supported and Continuous Beams, Detailing; Design of Canopy - Sketch Showing Reinforcement Details.

### UNIT-III

Design of One Way Slab, Two way Slabs for different Edge Conditions and Continuous Slab using IS Coefficients - Limit State Design for Serviceability for Deflection, Cracking - IS Code Provisions. Staircase - types of staircase - Design of Doglegged Staircase - Sketch Showing Reinforcement Details.

### UNIT-IV

Short and Long Columns - Under Axial Loads, Uniaxial Bending and Biaxial Bending - Interaction Diagrams – Slender Columns - IS Code Provisions - Sketch Showing Reinforcement Details.



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## UNIT-V

Footings: Different types of Footings - Design of Isolated, Square, Rectangular, Circular Footings and Combined Footings – Piles – types of piles - Design of Pile Cap - Sketch Showing Reinforcement Details.

### TEXT BOOKS:

1. Design of Reinforced Concrete Structures by S. Ramamrutham, Dhanpat Rai Publications.
2. Design Reinforced Concrete Structures by N. Krishna Raju, CBS Publications.
3. Design Reinforced Concrete Structures by V.N. Vazrani & M.M. Ratwani, Khanna Publishers.
4. Reinforced Concrete Design by S. Unnikrishna Pillai & Devdas Menon, Tata McGraw Hill.

### REFERENCE BOOKS:

1. Design of Reinforced Concrete Structures by N. Subramanian, McGraw Hill.
2. Reinforced Concrete Structures by I. C. Syal and A. K. Goel, S. Chand & Company.
3. Fundamentals of Reinforced Concrete by N.C. Sinha and S.K Roy, S. Chand Publishers.
4. Design of Concrete Structures by Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc-Graw Hill.
5. Reinforced Concrete Structures by Robert Park, Thomas Paulay.
6. IS 456-2000: Plain and Reinforced Concrete Code of Practice.
7. SP 16: Design Aids for Reinforced Concrete Design to IS 456-2000.
8. SP 34: Hand Book on Concrete Reinforcement and Detailing.



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## STRUCTURAL ANALYSIS-I - D15PC17

V Semester

L/T/P/C

3/0/0/3

**PRE REQUISITES:** Strength of Materials–I

### **COURSE OBJECTIVES:**

To make the students to understand the principles of analysis of structures subjected to static and moving loads by various methods.

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

1. Analyze Perfect, Imperfect And Redundant Frames.
2. Formulate Equilibrium and compatibility equations for structural members.
3. Analyze one dimensional and two dimensional problems using classical methods.
4. Analyze indeterminate structures.
5. Analyze structures for gravity loads, moving loads and lateral loads.

### **UNIT-I**

**Introduction to Structures and Indeterminacy:** Equilibrium and compatibility equations - types of supports and reactions, types of joints and equilibrium equations, Static and kinematic indeterminacies of beams and frames. Effect of force releases like moment hinge, shear releases, link on static indeterminacy, Relative Merits of indeterminate structures over determinate structures.

**Propped Cantilever and Fixed Beams:** Types of props : Elastic and Rigid props, Determination of - Analysis of Propped cantilever and fixed beams, including the beams with different moments of inertia, subjected to uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads – Shear force and Bending moment diagrams for Propped Cantilever and Fixed Beams– Deflection of Propped cantilever and fixed beams; effect of sinking of support, effect of rotation of a support.

### **UNIT-II**

**Frames:** Classification– plane and space frames, pin jointed and rigid jointed frames.

**Analysis of Perfect Frames:** Types of frames– Perfect, Imperfect and Redundant pin jointed frames, assumptions, transfer of load to joints from wind and other forces – Analysis of determinate pin jointed frames using method of joints and method of sections for vertical loads, horizontal loads and inclined loads, Tension coefficient method for pin jointed plane frames.

### **UNIT-III**

**Energy Theorems:** Introduction–Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces – Castigliano's first theorem–Unit Load Method. Deflections of simple beams and pin-jointed plane trusses.

**Three Hinged Arches:** Introduction–Types of Arches–Comparison between three hinged and two hinged Arches. Linear Arch. Eddy's theorem. Analysis of three hinged arches. Normal Thrust and radial shear in an arch. Geometrical properties of parabolic and circular arch. Three





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hinged circular arch at different levels. Absolute maximum bending moment diagram for a three hinged arch.

## UNIT-IV

**Slope Deflection Method:** Derivation of slope-deflection equation, application to continuous beams with and without settlement of supports. Shear force and bending moment diagrams and Elastic curve.

**Moment Distribution Method:** Application to continuous beams with and without settlement of supports. Shear force and bending moment diagrams and Elastic curve.

## UNIT-V

### Moving Loads and Influence Lines

Introduction –applications to bridges (only description), Definition of influence line for SF, Influence line for BM– load position for maximum SF at a section–Load position for maximum BM at a section – Point loads, UDL longer than the span, UDL shorter than the span– maximum SF and BM at a given section and absolute maximum and B.M due to single concentrated load UDL longer than the span, UDL shorter than the span, two point loads with fixed distance between them and several point loads- Equivalent uniformly distributed load– Focal length. Influence lines for forces in members of deck and through type trusses like Pratt and Warren trusses. Equivalent uniformly distributed load. Focal length. Muller Breslau's principle for determinate and indeterminate beams (qualitative).

### TEXT BOOKS:

1. Basic Structural Analysis by K.U. Muthu et.al, I.K International.
2. Structural Analysis Vol-I & II by V. N. Vazirani and M. M. Ratwani, Khanna Publishers.
3. Structural Analysis Vol-I & II by G. S. Pandit and S. P. Gupta, Tata McGraw Hill Education Pvt. Ltd.
4. Mechanics of Structures Vol-I and II by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.

### REFERENCE BOOKS:

1. Structural Analysis by R. C. Hibbeler, Pearson Education.
2. Structural Analysis by Devdas Menon, Narosa Publishing House.
3. Basic Structural Analysis by C. S. Reddy., Tata McGraw Hill Education Pvt. Ltd.
4. Fundamentals of Structural Analysis by M. L. Gambhir, PHI Learning Pvt. Ltd.
5. Structural Analysis -I by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd.
6. Theory of Structures by S. Ramamrutham, R. Narayan, Dhanpat Rai Publishing Company.



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## (PE-I) - TRANSPORTATION ENGINEERING - D15PE1

V Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITE:** Surveying and Geomatics

**COURSE OBJECTIVES:** To provide basic knowledge in transportation so that students can understand and be able to

1. Solve transportation related problems.
2. Understand and design various pavements in rural as well as highways.
3. Do geometric and pavement designs based on traffic volume studies.
4. Understand and design flexible and rigid pavements.

**COURSE OUTCOMES:** On Completion of the Course, the Students will be able to

1. Carry out surveys involved in planning and highway alignment.
2. Design the geometric elements of highways and expressways.
3. Carryout traffic studies and implements traffic regulation and control measures and intersection design.
4. Characterize pavement materials.
5. Design flexible and rigid pavements as per IRC.

### UNIT-I

**Highway Development and Planning:** Highway development in India - Necessity for Highway Planning Different Road Development Plans. Classification of Roads - Road Network Patterns - Highway Alignment - Factors affecting Alignment - Engineering Surveys - Drawings and Reports, Road Projects Initiation need based Planning.

### UNIT-II

**Highway Geometric Design:** Importance of Geometric Design - Design Controls and Criteria - Highway Cross Section Elements - Sight Distance Elements - Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance - Design of Horizontal Alignment - Design of Super elevation and Extra Widening - Design of Transition Curves - Design of Vertical Alignment - Gradients Vertical Curves. Typical Cross Sections for different types of Roads - Problems.

### UNIT-III

**Traffic Engineering:** Basic Parameters of Traffic, Volume, Speed and Density Road Accidents, Causes and Preventive measures - Accident Data Recording - Condition Diagram and Collision Diagrams. Road Traffic Signs - Types and Specifications - Road markings - Types of Road Markings - Design of Traffic Signals - Webster Method - IRC Method, Intelligent Transportation Systems - Typical Architectures, Highway Lighting.

### UNIT-IV

**Intersection Design:** Types of Intersections - Conflicts at Intersections - Types of Grade Intersections.





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**Channelization:** Objectives - Traffic Islands and Design Criteria - Types of Grade Separated Intersections - Rotary Intersection - Concept of Rotary and Design Criteria - Impacts of Geometrics on Intersection with reference to Safety, Operational Capacity.

## UNIT-V

**Introduction to Highway Materials and Pavement Design:** Introduction to Flexible Pavements, Rigid Pavement - Pavement Components and Functions - Design of Flexible Pavements and Rigid Pavements as per IRC - Stresses in Rigid & Flexible Pavements.

### TEXT BOOKS:

1. Highway Engineering by S.K. Khanna & C.E.G. Justo, Nemchand & Bros.
2. Highway Engineering Design by L.R. Kadiyali and Dr. NB Lal, Khanna Publications.
3. Text Book of Highway Engineering by R. Srinivasa Kumar, Orient Black Swan Pvt. Ltd.

### REFERENCE BOOKS:

1. Highway Engineering - S.P. Bindra by Dhanpat Rai Publications (P) Ltd.
2. Traffic Engineering & Transportation Planning by Dr.L.R. Kadyali, Khanna Publications.
3. Principles of Traffic Engineering by Nicholas J. Garber & Lester A. Hoel, Cengage Learning (India).
4. IRC 37-2018: Guidelines for the Design of Flexible Pavements.
5. IRC 58-2015: Guidelines for the Design of Plain Jointed Rigid Pavements for Highways.
6. IRC 35-2015: Code of Practice for Road Markings.
7. IRC 67-2012: Code of Practice for Road Signs.
8. MoRTH Specifications/ Standards.



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## (PE-I) - CONSTRUCTION EQUIPMENT & MATERIALS - D15PE1

V Semester

L/T/P/C

3/0/0/3

### COURSE OBJECTIVES:

1. To familiarize students about the characteristics of construction materials used in civil engineering.
2. To develop the skills for identification of suitable construction materials for civil engineering projects.
3. Ability to develop to select appropriate material for construction.

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

1. Manage the equipment, cost control and maintenance of a project.
2. Identify and understand the working principle of earthwork equipment.
3. Identify and understand the working of various equipment for different construction process.
4. Identify and understand the working principle of material handling equipment.
5. Understand the working of aggregate production and concreting equipment.

### UNIT-I

Large and Heavy Engineering Projects - Characteristics and Complexities, Methods of Statement for Major Activities like Excavation, Concreting, Steel Fabrication and Erection for Projects like Earthen Dams, Hydropower Projects, Nuclear Power Plant, Refineries and other Industrial Projects.

### UNIT-II

Excavation for heavy engineering projects - Excavation in Various types of Soils, Selection of Equipment, Safety Measures in Excavation, and Drainage in Excavation.

Concrete Construction for Heavy Engineering Projects - Selection of Equipment for Batching, Mixing, Transporting, Placing and Compacting for Various types of Jobs, Safety Measures during Concreting, Special Concretes and Mortars - Preplaced Aggregate Concrete, Roller Compacted Concrete, Grouting.

### UNIT-III

Prefabricated Construction - Planning for Pre-casting, Selection of Equipment for Fabrication, Transport and Erection, Quality Measures, Safety Measures during Erection. Steel construction - Planning for Field Operations, Selection of Equipment and Erection Tools, Tools and Methods of Welding, Tools and Methods of Cutting and Joining, Bridge Erection, Quality Measures, Safety Measures during Fabrication and Erection.

### UNIT-IV

Specific issues related to Planning, Site Layouts, Equipment Selection and Pre-project Activities for Large Size Construction Projects like Earthen Dams, Concrete Dams, Thermal Power Stations, Nuclear Power Stations, Light Houses, Airports and Ports, Bridges.



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## UNIT-V

Information related to Special Equipment and their Applications to Off-shore Construction, Underground Utility Construction. New Materials and Equipment for Construction; Case Studies of Heavy Construction Projects.

### TEXT BOOKS:

1. Construction Planning, Equipment and Methods by Purifoy, Schexnayder, Tata McGraw Hill.
2. Construction Equipment and Management by SC Sharma, Khanna Publishers.
3. Construction Equipment and Management for Engineers, Estimators & Owners by Douglas D. Gransberg, Callin M. Popescu, Richard C. Ryan, Taylor & Francis.
4. Erection of Constructional Steel Work by Thomas Baron.

### REFERENCE BOOKS:

1. Handbook of Heavy Construction by Stubbs.
2. Journals of Civil Engineering and Construction Engineering.
3. Construction Equipment and Job Planning by Deodhar, Khanna Publication.



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## (PE-I)- RAILWAY ENGINEERING - D15PE1

V Semester

L/T/P/C

3/0/0/3

### COURSE OBJECTIVES:

1. To make students understand about the concept of railway infrastructure
2. Be able to give plan and design railway components.
3. To ensure the reliable and safe operations of signaling system.

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

1. Understand the Importance of Railway Infrastructure Planning and Design.
2. Identify the factors Governing Design of Railway Infrastructures.
3. Maintenance of the Railway Track and Signal System for Safe Operations of Railways.
4. Safe Installation and Operations of Railway Track and Signaling System.
5. Maintenance of the Railway Track and Infrastructure.

### UNIT-I

**Introduction to Railways:** Planning of Railway Lines, Network Railway Operational System, Historical Background of Indian Railways, Plans and Developments, Traffic Forecast and Surveys, Railway Alignment, Project Appraisal and Organization Setup.

### UNIT-II

**Component of Railway:** Permanent Way, Forces Acting, Rails, Function of Rails, Rail Fixtures and Fastenings, Sleepers and Ballast, Rail Joints, Elements of Junctions and Layouts, Types of Traction, Locomotives and other Rolling Stock, Brake Systems, Resistance due to Friction, Wave Action, Wind, Gradient, Curvature, Tractive Effort of a Locomotive, Hauling Power of a Locomotive.

### UNIT-III

**Geometric Design of Railway Track:** Right of Way and Formation, Field Investigation, Geometric Design Elements, Safe Speed on Curves, Speed Computation, String Lining of Curves, Gradients, Grade Compensation, Railway Cant and Cant Deficiency, Traction.

**Track Construction and Maintenance:** Special Considerations and Construction Practices, Track Laying, Inspection and Maintenance, Maintenance Tools, Maintenance of Rail Surface, Track Drainage, Track Circuited Lengths, Track Tolerances, Mechanized Method, off-Track Tampers, Shovel Packing, Ballast Confinement and Directed Track Maintenance, Bridge Maintenance, Renewal, Classification of Renewal Works, through Sleeper Renewals, Mechanized Relaying, Track Renewal Trains.

### UNIT-IV

**Signaling and interlocking:** Objectives, Classification, Fixed Signals, Stop Signals, Signaling Systems, Mechanical Signaling System, Electrical Signaling System, Systems for Controlling Train Movement, Interlocking, and Modern Signaling Installations.



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## UNIT-V

**Railway Accidents and Safety:** Train Accidents, Collision and Derailments and their Causes, Restoration of Traffic, Safety Measures, Disaster Management, Classification of Level Crossings, Accidents at Level Crossings, Remedial Measures, Maintenance of Level Crossings.

### TEXT BOOKS:

1. Railway Engineering by Satish Chandra and M. Agrawal, Oxford University Press.
2. A Textbook of Railway Engineering by S.C.Saxena and S.P. Arora, Dhanpat Rai Publications (P) Ltd.
3. Railway Track Engineering by J.S. Mundrey, Tata McGraw Hill Education.

### REFERENCE BOOKS:

1. Practical Railway Engineering by Clifford F. Bonnett, Imperial College Press, London.
2. Railway Engineering by Gupta, B.L. and Amit Gupta, Standard Publishers and Distributors, Delhi.
3. Railway Engineering by S.C. Rangwala, Charotar Publishing House, Anand.



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## (PE-II) - INFRASTRUCTURE PLANNING AND MANAGEMENT - D15PE2

V Semester

L/T/P/C

3/0/0/3

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

1. Recognize the need to Plan, Manage and Maintain Infrastructure Projects at a High Level.
2. Demonstrate an Understanding of Reliability Theory.
3. Explain the Principles of Reliability Engineering and Reliability Engineering Processes.
4. Identify and be able to use Mathematical Tools and Techniques Commonly used in Systems Analysis.
5. Develop a System Engineering Management Plan for Practical Applications.

### UNIT-I

Introduction: Definition of Basic Terminologies, Role of Infrastructure in Economic Development, types of Infrastructure, Measurement of Infrastructure Capacity, Bases for Quantification of Demand and Supply of Various types of Infrastructure, Indian Scenario in respect of Adequacy and Quality.

### UNIT-II

Infrastructure Planning: Goals and Objectives of Infrastructure Planning; Identification and Quantification of the Casual Factors Influencing the Demand for Infrastructure; Review and Application of Techniques to Estimate Supply and Demand for Infrastructure; use of Econometric, Social and Land Use Indicators and Models to Forecast the Demand and Level of Service of Infrastructure and its Impact on Land Use; Critical Review of the Relevant Forecasting Techniques; Infrastructure Planning to Identify and Prioritize Preferred Areas for Development; Integration of Strategic Planning for Infrastructure at Urban, Regional and National Levels; Case Studies in Infrastructure Planning.

### UNIT-III

Infrastructure Management: Concepts, Common aspects of Urban and Rural Infrastructure Management systems; Buildings, Pavement and Bridge Management Systems, Integrated Infrastructure Management, Case Studies.

### UNIT-IV

Emerging Trends in Infrastructure: Overview of Public-Private Sector Participation in Infrastructure Projects, Understanding Stakeholder's Concerns, Regulatory Framework, Risk Management in Infrastructure Projects.

### UNIT-V

Public Policy for Infrastructure Sectorial Overview: Highways, Railways, Waterways, Airports, Urban and Rural Infrastructure: Roads, Housing, Water Supply, Sanitation - Case Study Examples.





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## TEXT BOOKS:

1. Infrastructure Engineering and Construction Techniques by M. R. Apte, R. K. Lad, V. R. Phadke, U. S. Patil, Nirali Prakashan Publishers.
2. Infrastructure Planning, Engineering and Economics by Alvin S. Goodman and Makarand Hastak, McGraw Hill.
3. Infrastructure Planning by James Parkin and Deepak Sharma, Thomas Telford Ltd.

## REFERENCE BOOKS:

1. Projects: Planning, Analysis, Selection, Financing, Implementation and Review by P. Chandra, Tata McGraw Hill, New Delhi.
2. Project Financing - Asset Based Financial Engineering by J. D. Finnerty, Wiley, New York.
3. Economic Analysis of Projects by Lyn Squire and H. G. van der Tak, John Hopkins University Press, London.
4. Managerial Economics: Theory and Practices by T. J. Webster, Elsevier, New Delhi.



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## (PE-II) - REMOTE SENSING & GEOGRAPHIC INFORMATION SYSTEM - D15PE2

V Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITE:** Surveying & Geomatics

**COURSE OBJECTIVES:** The objectives of the course are to

1. Know the concepts of Remote Sensing, its interpreting Techniques and concepts of Digital images
2. Know the concept of Geographical Information System (GIS), coordinate system GIS Data and its types.
3. Understand the students managing the spatial Data Using GIS.
4. Understand Implementation of GIS interface for practical usage.

**COURSE OUTCOMES:** After completing this course the student will be able to

1. Understand the concepts and principles of aerial photogrammetry and compute heights of the objects using relief displacement and parallax.
2. Understand the principles and basic concept of Remote Sensing and GIS and its applications; know different types of data representations in GIS.
3. Understand the map projections and coordinates systems.
4. Understand the application of vector and raster data structures to the real world.
5. Understand the importance of source map and on-screen digitization.

### UNIT-I

**Introduction to Photogrammetry:** Principles & Types of Aerial Photographs, Geometry of Vertical Aerial Photograph, Scale & Height Measurement on Single Vertical Aerial Photograph, Height Measurement Based on Relief Displacement, Fundamentals of Stereoscopy, Fiducial Points, Parallax Measurement using Fiducial Line.

### UNIT-II

**Remote Sensing:** Basic Concept of Remote Sensing, Data and Information, Remote Sensing Data Collection, Remote Sensing Advantages & Limitations, Remote Sensing Process. Electro-magnetic Spectrum, Energy Interactions with Atmosphere and with Earth Surface Features (Soil, Water, Vegetation), Indian Satellites and Sensors, IKONOS Satellite Sensor, Blue Bird Satellites - Their Characteristics, Resolution, Map and Image, False Color and True Color Composite, Introduction to Digital Data, Elements of Visual Interpretation Techniques.

### UNIT-III

**Geographic Information Systems:** Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data, Attribute data - Joining Spatial and Attribute data; GIS Operations: Spatial Data Input - Attribute data Management - Data display - Data Exploration - Data Analysis. Coordinate Systems: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections - Map Projection Parameters - Commonly used Map Projections - Projected Coordinate Systems.



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## UNIT-IV

**Vector Data Model:** Representation of Simple Features - Topology and its Importance; Coverage and its Data Structure, Shape File; Data Models for Composite Features; Object Based Vector Data Model; Classes and their Relationships; The Geobase Data Model; Geometric Representation of Spatial Feature and Data Structure, Topology Rules.

## UNIT-V

**Raster Data Model:** Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, Creating new data; Remote Sensing data, Field Data; Text Data; Digitizing, Scanning, On-screen Digitizing, Importance of Source Map, Data Editing. Demonstration of GIS Software - GIS Applications: Environment, Water Resources and Agriculture.

## TEXT BOOKS:

1. Elements of Photogrammetry with Applications in GIS, Paul R. Wolf - Bon A. Dewitt - Benjamin E. Wilkinson.
2. Geographic Information Systems: A Management Perspective by Stan Aronoff, WDL Publications.
3. Remote Sensing of the Environment - An Earth Resource Perspective by John R. Jensen, Pearson Education.
4. Introduction to Geographic Information System by Kang-Tsung Chang, Tata McGraw Hill.

## REFERENCE BOOKS:

1. Concepts & Techniques of GIS by C.P. Lo Albert, K.W. Young, Prentice Hall (India).
2. Remote Sensing and Geographical Information systems by M. Anji Reddy.
3. Principles of Geo physical Information Systems by Peter A Burrough and Rachael A. Mc Donnell, Oxford University Press.
4. Basics of Remote Sensing & GIS by S. Kumar, Laxmi Publications Pvt. Ltd.
5. [www.iirs.gov.in](http://www.iirs.gov.in)
6. [www.easyengineering.net](http://www.easyengineering.net)



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## (PE-II) - SOLID AND HAZARDOUS WASTE MANAGEMENT - D15PE2

V Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITES:** Environmental Engineering

### COURSE OUTCOMES:

1. To understand environmental problems arising due to improper disposal of solid waste.
2. To analyse and mitigate the environmental issues due to hazardous waste management.
3. To apply standard methods for collecting, handling and safe disposal of biomedical and e-waste.
4. To know the appropriate method for solid waste collection, transportation, redistribution and disposal.
5. To evaluate an alternate technology to reduce the impact of solid waste in the environment.

### UNIT-I

**Introduction:** Definition of Solid Waste - Type of Solid Wastes - Sources of Solid Wastes - Generation of Solid Waste; Characteristics - Methods of Sampling and Characterization - Impact on Environmental Health - Elements of Solid Waste Management - Municipal Solid Waste (M&H) Rules - Public Awareness. On-site Storage Methods - Materials used for Containers - On-site Segregation of Solid Wastes - Public Health & Economic Aspects of Storage.

### UNIT-II

**Municipal Solid Waste Management:** Source Types - Composition - Estimation of Physical, Chemical Characteristics - Conditions - Collection of Solid Wastes - Analysis of Collection System - Alternative Collection System - Separation of Solid Waste - Material Recovery - Type of Vehicles - Collection Route - Transfer and Transport - Transfer Station - Selection of Location Dumping of Solid Waste, Landfills and Sanitary Landfills - Leachate collection & treatment - Site Selection and Design Operation. Energy Recovery - Incineration, Composting, Pyrolysis.

### UNIT-III

**Hazardous Waste Management:** Definition of Hazardous Waste (HW) - Characteristics of HW - Different Type of Hazardous Wastes - TCLP Tests - Storage, Labeling and Handling of Hazardous Wastes - Effects of Improper Management Hazardous Wastes Regulation - Hazardous Wastes Minimization - Labeling and Handling of Hazardous Wastes - Treatment and disposal of Hazardous wastes - Hazardous Waste Management in India - Remediation of Hazardous Landfill Sites.

### UNIT-IV

**Biomedical and Radioactive Wastes Management:** Biomedical Waste Classification, Collection, Segregation Treatment and Disposal - Radioactive Wastes - Definition - Low Level and High Level Radioactive Wastes and their Management, Radiation Standards.



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## UNIT-V

**E-Waste and Plastic Waste Management:** Waste Characteristics, Generation, Collection, Transport and Disposal, Regulatory aspects of E-Waste, Global Strategy, Recycling - Plastic Waste, its Disposal and Utilization - Environmental Issues and Challenges - Novel Idea to Utilize Thick Plastic Bags.

### TEXT BOOKS:

1. Solid & Hazardous Waste Management by M.N. Rao, Razia Sultana, Sri Harsha Kota, B.S. Publications.
2. Handbook of Solid Waste Management by George Tchobanoglous and Frank Kreith, McGraw Hill, New York.

### REFERENCE BOOKS:

1. Manual on Municipal Solid Waste Management - 2016, Central Public Health & Environmental Engineering Organization (CPHEEO), Ministry of Housing and Urban Affairs, Government of India. [<http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php>]
2. Design of Landfills and Integrated Solid Waste Management by Amalendu Bagchi, Wiley.
3. Information on Common Hazardous Waste Treatment, Storage and Disposal Facilities from CPCB, Government of India. [<https://cpcb.nic.in/common-hw-tsdfs/>]



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## HYDRAULICS & HYDRAULIC MACHINERY LAB - D15PC18

V Semester

L/T/P/C

0/0/2/1

**PRE-REQUISITES:** Fluid Mechanics and Hydraulic Machinery

**COURSE OUTCOMES:** At the end of the Course, the Student will be able to

1. Determine for Orifice meter and Venturimeter.
2. Test the Performance of Pumps and Turbines.
3. Determine Energy Loss in Hydraulic Jump.

### LIST OF EXPERIMENTS:

1. Calibration of Venturimeter/ Orifice meter.
2. Calibration of Contracted Rectangular Notch/ Triangular Notch.
3. Determination of Major and Minor Losses.
4. Verification of Bernoulli's Equation.
5. Impact of Jet on Vanes (Flat Bed/ Curved Bed/ Inclined)
6. Performance Test on Pelton Wheel Turbine.
7. Performance Test on Francis Turbine at Constant Speed and Constant Head.
8. Performance Characteristics of a Single Stage/ Multi-stage Centrifugal Pump.
9. Performance Characteristics of a Reciprocating Pump.
10. Study of Hydraulic Jump in Open Channel by Mannings and Chezy.
11. Demonstration on Kaplan Turbine Constant Head and Constant Speed.
12. Demonstration on Reynold's Experiment.

### REFERENCES BOOKS:

1. Laboratory Manual of Fluid Mechanics and Machines, V. P. Gupta, J. Chandra, K. S. Gupta, CBS Publishers & Distributors Pvt. Ltd.
2. Hydraulics Laboratory Manual by S.K Likhi, New Age International (P) Limited.





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## ADVANCED ENGLISH COMMUNICATION SKILLS LAB - D5HSE3

V Semester

L/T/P/C

0/0/4/2

### A. INTRODUCTION

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3<sup>rd</sup> year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. Taking part in social and professional communication.

### B. COURSE OBJECTIVES

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. To improve the students' fluency in English, with a focus on vocabulary
2. To enable them to listen to English spoken at normal conversational speed by educated English speakers
3. To respond appropriately in different socio-cultural and professional contexts
4. To communicate their ideas relevantly and coherently in writing
5. To prepare the students for placements.

### C. COURSE OUTCOMES

1. Build up their vocabulary thereby improving their fluency in speaking.
2. Comprehend English spoken at a normal conversational speed by proficient English language speakers.
3. Appropriately structure their writing while conveying their ideas coherently.
4. Use the right body language and make presentations very effective while dealing with gloss phobia or stage fear.
5. Improve their employability skills by participating effectively in group discussions and interviews.

### D. SYLLABUS

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques



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of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub-skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice.

2. **Activities on Writing Skills:** Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing –Writing a Letter of Application –Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.
3. **Activities on Presentation Skills** - Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation.
4. **Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do's and Don'ts - GD Strategies – Exercises for Practice.
5. **Interview Skills:** Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

## E. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

1. Spacious room with appropriate acoustics.
2. Round Tables with movable chairs.
3. Audio-visual aids.
4. LCD Projector.
5. Public Address system.
6. One PC with latest configuration for the teacher.
7. T. V, a digital stereo & Camcorder
8. Headphones of High quality



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## F. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and used.

1. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
2. Oxford Advanced Learner's Dictionary, 10<sup>th</sup> Edition
3. Cambridge Advanced Learner's Dictionary
4. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
5. Lingua TOEFL CBT Insider, by Dreamtech.

## G. BOOKS RECOMMENDED:

1. Rizvi, M. Ashraf (2018) Effective Technical Communication. (2<sup>nd</sup> ed.) McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015) Engineering English. Orient Black Swan Pvt. Ltd.
3. Bailey, Stephen. (2018) Academic Writing: A Handbook for International Students. (5<sup>th</sup> Edition) Routledge.
4. Koneru, Aruna (2016). Professional Communication. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta (2022) Technical Communication, Principles and Practice. (4<sup>TH</sup> Edition) Oxford University Press.
6. Anderson, Paul V. (2007) Technical Communication. Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017) English Vocabulary in Use Series. Cambridge University Press
8. Sen, Leela. (2009) Communication Skills. PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998) Writing with Power. Oxford University Press.
10. Goleman, Daniel. (2013) Emotional Intelligence: Why it can matter more than IQ. Bloomsbury Publishing.



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## COMPUTER AIDED DETAILED DRAWING LAB – D15ESCA2

V Semester

L/T/P/C

0/0/2/1

**COURSE OUTCOMES:** At the end of the Course

1. The students will be able to draw the 2D building plan for distinct plot measurements.
2. The students will be able to draw the elevation of the building in 2D.
3. The students will be able to draft various structures.

### LIST OF EXPERIMENTS:

1. Drawing of plans of single storied buildings.
2. Drawing of plans of multi storied buildings.
3. Developing section and elevation for single /multi storied building.
4. Detailing of reinforcement in beams.  
(i) Cantilever, (ii) Simply supported, (iii) Continuous
5. Detailing of reinforcement in columns  
(i) Square, (ii) Rectangular, (iii) Circular
6. Detailing of reinforcement in RCC isolated footings.  
(i) Square, (ii) Rectangular, (iii) Combined Footing
7. Detailing of reinforcement in RC one-way and two-way slabs.
8. Detailing of reinforcement in RC dog-legged staircases / open well staircases.
9. Draw a layout of structural details for a building - columns layout & center line drawing.
10. Draw a layout of structural details for a building - footings layout.
11. Draw a layout of structural details for a building - beams layout.
12. Draw a layout of structural details for a building - slab layout.

### TEXT BOOKS:

1. Civil Engineering Drawings (Including Computer Aided Building Drawing), Third Edition by Rangwala, Charotar Publishers.
2. Computer Aided Design Laboratory by M. N. Shesha Prakash, G. S. Suresh, Laxmi Publications Pvt. Ltd.
3. Computer Aided Drafting Lab by V. Ramesh Babu, R. Samyukta, M. Muniratnam, VRB Publishers Pvt. Ltd.
4. SP 34, Handbook on Concrete Reinforcement and Detailing.
5. IS 456-2000: Plain and Reinforced Concrete Code of Practice.



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## CONSTITUTION OF INDIA\*

V Semester

L/T/P/C

3/0/0/0

### COURSE OBJECTIVES:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevikin Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

### COURSE OUTCOMES:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

### UNIT - I

History of Making of the Indian Constitution- History of Drafting Committee. Philosophy of the Indian Constitution- Preamble Salient Features.

### UNIT - II

Contours of Constitutional Rights & Duties - Fundamental Rights

- a) Right to Equality
- b) Right to Freedom
- c) Right against Exploitation
- d) Right to Freedom of Religion
- e) Cultural and Educational Rights
- f) Right to Constitutional Remedies
- g) Directive Principles of State Policy
- h) Fundamental Duties.

### UNIT - III

**Organs of Governance:** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

### UNIT - IV

**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.



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Panchayat raj: Introduction, PRI: Zilla Panchayat. Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

## UNIT - V

**Election Commission:** Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

## SUGGESTED READING:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1<sup>st</sup> Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7<sup>th</sup> Edition, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.





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## SOIL MECHANICS - D16PC19

VI Semester

L/T/P/C

3/0/0/3

### COURSE OBJECTIVES:

To enable the student to study the properties of soil and to determine the behavior of soil under various conditions and loads.

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

1. To understand the Mechanism of Behavior of Soil for different loads.
2. Determine Properties of Soil.
3. Understand Various Stresses and their Distribution in Soil and Other Engineering Properties of Soil.
4. Understand Shear Strength of Soil and Various Techniques for Improving the Shear Strength.

### UNIT-I

**Introduction:** Soil formation, Clay Mineralogy and Soil Structure - Moisture Content – Mass-Volume Relationship - Relative Density.

**Index Properties of Soils:** Grain Size Analysis - Sieve Analysis - Hydrometer Method - Consistency Limits and Indices - IS Classification of Soils.

### UNIT-II

**Permeability:** Soil Water - Capillary Rise - Flow of Water through Soils - Darcy's Law of Permeability - Factors Affecting Permeability - Laboratory Determination of Coefficient of Permeability - Permeability of Layered Soils - In-situ Permeability Tests.

**Effective Stress & Seepage Through Soils:** Total, Neutral and Effective Stress - Principle of Effective Stress - Critical Hydraulic Gradient - Quick Sand Condition - Seepage through Soils.

**Flow Nets:** Characteristics and Uses.

### UNIT-III

**Stress Distribution In Soils:** Boussinesq's and Westergaard's theories for Point Load, Uniformly Loaded Circular and Rectangular Areas, Pressure Bulb, Variation of Vertical Stress under Point Load along the Vertical and Horizontal Plane, and Newmark's Influence Chart for Irregular Areas.

**Compaction:** Mechanism of Compaction and its necessity - factors affecting Compaction, Effects of Compaction on Soil Properties - Field Compaction Equipment - Compaction Quality Control.

### UNIT-IV

**Consolidation:** Types of compressibility - Immediate Settlement, Primary Consolidation and Secondary Consolidation - Stress History of Clay; e-p and e-log (p) curves - Normally Consolidated Soil, Over-Consolidated Soil and Under-Consolidated Soil - Pre-consolidate Pressure and its Determination - Terzaghi's 1-D Consolidation Theory - Coefficient of Consolidation - Square Root Time and Logarithm of Time Fitting Methods - Computation of Total Settlement and Time Rate of Settlement.



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## UNIT-V

**Shear Strength of Soils:** Importance of Shear Strength - Mohr's, Coulomb Failure Theories - Types of Laboratory Tests for Strength Parameters (Direct shear test, Triaxial compression test, Unconfined compression test, Vane shear test) - Strength Tests based on Drainage Conditions (Unconsolidated and Consolidated) - Strength Envelops - Dilatancy - Critical Void Ratio – Skempton's pore water parameters.

### TEXT BOOKS:

1. Soil Mechanics and Foundation Engineering By K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New Age International Pvt. Ltd.
3. Soil Mechanics and Foundation by B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications Pvt. Ltd.
4. Principals of Geotechnical Engineering by Braja M. Das, Cengage Learning (India).

### REFERENCE BOOKS:

1. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
2. Geotechnical Engineering by C. Venkataramaiah, New Age International Pvt. Ltd.
3. Geotechnical Engineering by Manoj Dutta & Gulati S.K, Tata McGraw Hill.
4. Geotechnical Engineering Principles and Practices by Donald Coduto, Man-chu Ronald Yeung, William Kitch, Pearson Education.



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## ENVIRONMENTAL ENGINEERING - D16PC20

VI Semester

L/T/P/C

3/0/0/3

### COURSE OBJECTIVES:

1. To get knowledge of water sources, water treatment, design of distribution systems.
2. To understand various water & waste water treatments and their safe disposal methods.
3. To design various water and waste water treatment units.

**COURSE OUTCOMES:** The students completing the course will

1. Estimate Quantities of Water and Waste Water and Plan Conveyance Components.
2. Assess Characteristics of Water and Wastewater and their Impacts.
3. To know about the Layouts, Principles of Treatment Nits and Filters
4. Design Components of Water and Wastewater Treatment Plants.
5. Be Conversant with issues of Air Pollution, Noise pollution and Control.

### UNIT-I

Introduction: Waterborne Diseases - Protected Water Supply - Population Forecasts, Design Period - Types of Water Demand - Factors Affecting - Fluctuations - Fire Demand - Water Quality and Testing - Drinking Water Standards: Sources of Water - Comparison from Quality and Quantity and other Considerations - Intakes - Infiltration Galleries.

Sources: Surface and Subsurface Sources - Suitability with regard to Quality and Quantity.

### UNIT-II

Layout and General Outline of Water Treatment Units - Sedimentation - Principles - Design Factors - Coagulation - Flocculation Clarifier Design - Coagulants - Feeding Arrangements. Filtration - Theory - Working of Slow and Rapid Gravity Filters - Multimedia Filters - Design of Filters - Troubles in Operation - Comparison of Filters - Disinfection - Theory of Chlorination, Chlorine Demand - other Disinfection Practices - Design of Distribution Systems - Pipe Appurtenances.

### UNIT-III

Characteristics of Sewage - Wastewater Collection - Estimation of Wastewater and Storm Water Decomposition of Sewage, Examination of Sewage - B.O.D. Equation - C.O.D. Design of Sewers -Shapes and Materials - Sewer Appurtenances, Manholes - Inverted Siphon - Catch Basins - Flushing Tanks - Ejectors, Pumps and Pump Houses - House Drainage - Plumbing Requirements - Sanitary Fittings - Traps - One Pipe and Two Pipe Systems of Plumbing - Ultimate Disposal of Sewage - Sewage Farming - Self-Purification of Rivers.

### UNIT-IV

Wastewater Treatment Plant - Flow Diagram - Primary Treatment Design of Screens - Grit Chambers - Skimming Tanks - Sedimentation Tanks - Principles of Design - Biological Treatment Trickling Filters - ASP - Construction and Design of Oxidation Ponds. Sludge Digestion - Design of Digestion Tank - Sludge Disposal by Drying - Septic Tanks - Working Principles and Design - Soak Pits - Wet Land Management.



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## UNIT-V

Air Pollution - Classification of Air Pollution - Effects Air Pollution - Global Effects - Meteorological Parameters Affecting Air Pollution - Atmospheric Stability - Plume Behavior - Control of Particulates - Gravity Settlers, Cyclone Filters, ESPs - Control of Gaseous Pollutants Automobile Pollution and Control. Global Effects of Air Pollution - Green House Effect, Heat Islands, Acid Rains, Ozone Holes.

Noise Pollution: Causes and effects of noise pollution - Measurement of noise pollution - standard values.

## TEXT BOOKS:

1. Water Supply and Sanitary Engineering by G.S. Birdie, Dhanpat Rai Publications (P) Ltd.
2. Environmental Engineering Vol - I and II by BC Punmia, Standard Publications.
3. Water Supply Engineering by S.K. Garg, Khanna Publishers.
4. Environmental Engineering Vol - I by S.K.Garg, Khanna Publishers.

## REFERENCE BOOKS:

1. Water Supply Engineering Vol - I & II by P.N. Modi, Standard Book House, New Delhi.
2. Water Supply Engineering by B.C. Punmia, Ashok K Jain and Arun K Jain, Laxmi Publications Pvt. Ltd.
3. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi.
4. Water Works Engineering Planning - Design and Operation by Syed R. Qasim and Edward M. Motley Guang Zhu, Prentice Hall (India), New Delhi.
5. Environmental Engineering by H.S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill.
6. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr. Wiley.
7. Environmental Pollution and Control Engineering by CS Rao, Wiley Publications.
8. Environmental Engineering by P. Venugopal Rao, Prentice Hall (India).



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## DESIGN OF STEEL STRUCTURES - D16PC21

VI Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITES:** Strength of Materials, Structural Analysis.

**COURSE OBJECTIVES:** The objective of this course is,

1. To study the design of bolted and welded connections.
2. To learn IS 800-2007 code of practice for the design of compression and tension members.
3. To study the behavior and design of Flexural members using simple and built-up sections.
4. To study the components of truss, loads on trusses, analysis and design of purlins and truss members.
5. To understand behavior of plate girder members and the design of plate girder.

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

1. Design Bolt and Weld Connections.
2. Design Tension and Compression Members.
3. Design Beams and Built-up Sections.
4. Design of Roof Trusses.
5. Design of Plate Girders and Roof Trusses.

### UNIT-I

Materials - Types of Structural Steel - Mechanical Properties of Steel - Concept of Plasticity - Yield strength. Loads and Combinations, Local Buckling Behavior of Steel. Concept of Limit State Design - Limit States - Design Strengths - Deflections Limits - Serviceability - Stability Check. Bolted Connections - IS 800-2007 - Specifications - Design Strength - Efficiency of Joint - Prying Actions - Welded Connections - Types of Welded Joints - Specifications - Design Requirements.

### UNIT-II

Design of Tension Members - Net Area - Shear Lag - Design Procedure Splice - Lug Angle. Design of Compression Members - Buckling Class - Slenderness Ratio/ Strength design - Laced - Battened Columns - Splices - Column Bases. Detailing of Structural Members.

### UNIT-III

Flexural Members - Classifications of Beams as per IS 800-2007 - Design of Beams - Bending and Shear Strength/ Buckling – Built-up Sections - Laterally Supported Beams - Design of Eccentric Connections - Framed - Stiffened/Seated Connections- Detailing of Structural Members.

### UNIT-IV

Roof Trusses - Components of a Trussed Roof - Types of Roof Trusses - Purlin Design - Wind Ties, Tie Rods - Loads on Trusses - Truss Design, Design of Joints and End Bearing - Detailing of Structural Members.



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## UNIT-V

Design of Plate Girders - Elements - Economical Depth - Design of Main Sections - Connections between Web and Flange - Design of Stiffness Bearing - Intermediate Stiffeners - Design of Flange Splices - Detailing of Structural Members.

### TEXT BOOKS:

1. Limit State Design of Steel Structures, S.K Duggal, Tata McGraw Hill.
2. Design of Steel Structures by S.S. Bhavikatti, IK International Publication House, New Delhi.
3. Design of Steel Structures by N. Subramanian, Oxford University Press.

### REFERENCE BOOKS:

1. Design of Steel Structures by K.S. Sai Ram, Pearson Education.
2. Design of Steel Structures by Edwin H. Gaylord, Jr. Charles N. Gaylord and James Stallmeyer, Tata Mc-Graw Hill Education.
3. Fundamental of Structural Steel Design by M.L. Gambhir McGraw Hill Pvt. Ltd.
4. IS 800-2007 General Construction in Steel - Code of Practice.
5. IS 875-Part-III for Wind Loads.
6. Steel Tables in SI Units





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## STRUCTURAL ANALYSIS-II - D16PC22

VI Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITES:** Structural Analysis

### COURSE OBJECTIVES:

1. To study behavior of arches and their methods of analysis
2. To understand the methods of analysis of intermediate trusses for external loads, lack of fit and thermal effect.
3. To know the concept and analysis of continuous beams and frames.
4. To study the multi-storey frames subjected to gravity loads and lateral loads.
5. To understand the influence line concepts for indeterminate structures.

### COURSE OUTCOMES:

1. Apply the methods of indeterminate truss analysis.
2. Demonstrate the behavior of arches and their methods of analysis.
3. Analyze the frames by slope deflection and moment distribution methods.
4. Analyze multi-storey frames subjected to gravity loads and lateral loads.
5. Demonstrate the concepts of qualitative influence line diagram for continuous beams and frames.

### UNIT-I

**Indeterminate Trusses:** Determination of Static and Kinematic Indeterminacies - Analysis of Trusses having Single Degree of Internal and External Indeterminacies.

**Two Hinged Arches:** Introduction - Classification of Two Hinged Arches - Analysis of Two Hinged Parabolic Arches - Secondary Stresses in Two Hinged Arches due to Temperature and Elastic Shortening of Rib.

**Analysis of Frames:** Castigliano's Second Theorem.

### UNIT-II

**Slope Deflection Method:** Analysis of Single Bay - Single Storey Portal Frames by Slope Deflection Method Including Side Sway. Shear force and Bending Moment Diagrams. Elastic Curve, Analysis of Inclined frames - Elastic Curve.

**Moment Distribution Method:** Analysis of Single Bay Single Storey Portal Frames including Side Sway Analysis of Inclined frames.

### UNIT-III

**Kani's Method:** Analysis of Continuous Beams including Settlement of Supports. Analysis of Single Bay Single Storey and Single Bay Two Storey Frames by Kani's Method Including Side Sway, Shear Force and Bending Moment Diagrams - Elastic Curve.

### UNIT-IV

**Matrix Methods of Analysis (System Approach):** Introduction - Static and Kinematic Indeterminacy - Analysis of Continuous Beams including Settlement of Supports, using Stiffness Method. Analysis of Pin-jointed Plane Frames using Stiffness Method - Analysis of



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Continuous Beams up to Three degrees of Indeterminacy using Flexibility Method - Shear Force and Bending Moment Diagrams.

## UNIT-V

**Approximate Methods of Analysis:** Introduction - Analysis of Multi-Storey Frames for Lateral Loads: Portal Method, Cantilever Method and Factor Method. Analysis of Multi-storey Frames for Gravity (Vertical) Loads. Substitute Frame method.

**Influence Lines for Indeterminate Beams:** Introduction - Influence Line Diagram (ILD) for two Span Continuous Beams with Constant and Variable Moments of Inertia. ILD for Propped Cantilever Beams. Muller Breslau's Principle.

## TEXT BOOKS:

1. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publications (P) Ltd.
2. Structural Analysis - II by S.S. Bhavikatti, Vikas Publishers.
3. Structural Analysis I & II by R. Vidyanathan, P. Perumal, Laxmi Publications Pvt. Ltd.
4. Structural Analysis by R. C. Hibbeler, Pearson Education.
5. Analysis of Structures (Vol. I) by Prof. VN. Vazirani, Dr. MM. Ratwani and Dr. SK Duggal, Khanna Publishers.

## REFERENCE BOOKS:

1. Structural Analysis: A Matrix Approach by Pandit & Gupta, McGraw Hill.
2. Basic Structural Analysis by C. S. Reddy, Tata McGraw Hill.
3. Advanced Structural Analysis by A. K. Jain, Nemchand & Bros.
4. Structural Analysis SI edition by Aslam Kassimali, Cengage Learning (India).
5. Indeterminate Structural Analysis by K.U.Muttu et al., I.K. Publishing.



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## (PE III) - WATER RESOURCES ENGINEERING - II - D16PE3

VI Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITES:** Water Resources Engineering-I

### COURSE OBJECTIVES:

1. Introduce Students to the Structure of the Dams, Earth Dam, Canals, Spillways and Cross Drainage Works.
2. Learn to Estimate the Capacity of Reservoir using Mass Curve.
3. Design the Principle of Sarda Type, Trapezoidal Notch, Straight Glacis Fall.
4. Necessity and Importance of Diversion, Storage Head Works, Weir and Barrages.
5. Determine the Uplift Pressure, Impervious Floors using the theory.

### COURSE OUTCOMES:

1. To know the types of Reservoirs, Zones of Storages of a Reservoir.
2. Know about the Merits and Demerits of Dams, Factor Effecting Selection of Dams, Gravity Dams, Earth Dams, Canals, and Spillways.
3. The Causes of Failure of the Dams, Canals and Spillways.
4. The design of Reservoir, Canals, Diversion; Storage Headworks by the Bligh's and Khosla's theory.
5. Understand about Types of Falls in Canals and its application which have designed in all the Cases.

### UNIT-I

**Storage Works:** Types of Reservoirs, Selection of Site for Reservoir, Zones of Storage of a Reservoir, Reservoir Yield, Estimation of Capacity of Reservoir using Mass Curve - Reservoir Sedimentation - Life of Reservoir.

**Dams:** Classification of Dams, Types of Dams, Factors Affecting Selection of Types of Dam, Factors Governing Selection of Site for a Dam.

### UNIT-II

**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 Low Gravity Dam, Factors of Safety - Stability Analysis, Foundation for a Gravity Dam, Drainage and Inspection Galleries.

### UNIT-III

**Earth Dams:** Types of Earth Dams, Causes of failure of Earth Dam, Criteria for Safe Design of Earth Dam, Seepage through Earth Dam - Graphical Method, Measures for Control of Seepage. **Spillways:** Types of Spillways, Design Principles of Ogee Slipways - Spillway Gates. Energy Dissipaters and Stilling Basins, Significance of Jump, Height Curve and Tail Water Rating Curve - USBR and Indian Types of Stilling Basins.



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## UNIT-IV

**Diversion Head Works:** Types of Diversion Head Works - Weirs and Barrages, Layout of diversion Head Work - Components. Causes and Failure of Weirs and Barrages on Permeable Foundations, Silt Ejectors and Silt Excludes, Weirs on Permeable Foundations - Creep Theories – Bligh's Lane's and Khosla's theories. Determination of Uplift Pressure - Various Correction Factors - Design Principles of Weirs on Permeable Foundations using Creep Theories. Exit Gradient, U/s and D/s Sheet Piles - Launching Apron.

## UNIT-V

**Canal Falls:** Types of Falls and Their Location, Design Principle of Notch Fall. Canal Regulation Works, Design Principles of Distributors and Head Regulators, Cross Regulators - Canal Outlets, Types of Canal Modules, Cross Drainage Works Types - Selection of a Site.

## TEXT BOOKS:

1. Irrigation Engineering and Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers.
2. Irrigation and Water Power Engineering, Dr. B. C. Punmia, Dr. Pande B., B. Lal, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publication Pvt. Ltd., New Delhi.
3. Irrigation Water Power and Water Resource Engineering, K.R. Arora, Standard Publishers Distributors.

## REFERENCE BOOKS:

1. Irrigation and Water Resources Engineering by G.L Asawa, New Age International Publishers.
2. Theory and Design of Irrigation Structures by R. S. Varshney, Gupta & Gupta, Nem Chand & Bros.
3. Irrigation Engineering by R.K. Sharma and T.K.Sharma, S.Chand Publishers.
4. Introduction to Hydrology by Warren Viessvann Jr., Gary L Lewis, Prentice Hall (India).
5. Engineering Hydrology by C.S.P. Ojha, R. Berndtsson and P. Bhunya, Oxford University Press.



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## (PE III) - GROUND IMPROVEMENT TECHNIQUES - D16PE3

VI Semester

L/T/P/C

3/0/0/3

**PRE-REQUISITES:** Soil Mechanics.

### **COURSE OBJECTIVES:**

1. Principles of Treatment for Granular and Cohesive Soils and Various Stabilization techniques.
2. Apply Knowledge on Ground Improvement Techniques such as Reinforced Earth, Drainage and Dewatering and Grouting Techniques on Stabilization of Expansive Soils.
3. Impart Knowledge of Mechanical Modification Techniques such as Deep Compaction, Blasting, Vibro-compaction, Dynamic Tamping and Compaction Piles.
4. Familiarize with different Ground Improvement Techniques for Cohesive and Granular Soils.
5. Understand the Concept of Reinforced Earth, Geo-synthetic and Soil Reinforcement in Ground Improvement.

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

1. Identify the Type of Problems in Problematic Soils and their Solutions by using different Ground Improvement Techniques.
2. Understand the Importance of Vibro-compaction and Compaction Piles on In-situ Densification of Soil.
3. Apply Dewatering Methods using Well Point System and Electro-Osmotic methods.
4. Apply Physical and Chemical Ground Improvement Techniques Using Thermal Modification like Grouting, Shotcreting and Guniting Technology.
5. Design Soil Reinforcement by Using Ground Anchors, Rock Bolting.

### **UNIT-I**

Introduction to Ground Modification: Need and Objectives, Identification of Soil Types, In-situ and Laboratory Tests to Characterize Problematic Soils; Mechanical, Hydraulic, Physico-Chemical, Electrical, Thermal Methods and their Applications.

### **UNIT-II**

Mechanical Modification - Deep Compaction Techniques - Blasting Vibro Compaction, Dynamic Temping and Compaction Piles.

### **UNIT-III**

Hydraulic Modification - Objectives and Techniques, Traditional Dewatering Methods and their Choice, Design of Dewatering System, Electro-Osmosis, Electro-Kinetic Dewatering. Filtration, Drainage and Seepage Control with Geo-Synthetic, Preloading and Vertical Drains.

### **UNIT-IV**

Physical and Chemical Modification - Modification by Admixtures, Shotcreting and Guniting Technology, Modification at Depth by Grouting, Crack Grouting and Compaction Grouting, Jet Grouting, Thermal Grouting, Ground Freezing.



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## UNIT-V

Modified by Inclusion and Confinement - Soil Reinforcement, Reinforcement with Strip and Grid Reinforcement Soil. In-situ Ground Reinforcement, Ground Anchors, Rock Bolting and Soil Nailing.

### TEXT BOOKS:

1. Ground Improvement Techniques by P. Purushotham Raj, Laxmi Publications.
2. Engineering Principles of Ground Modifications, Hausmann, M.R, McGraw Hill.
3. An Introduction to Ground Improvement Engineering by S Mittal, Medtech Publisher.

### REFERENCE BOOKS:

1. Design with Geosynthetic by Koerner R. M, Prentice Hall, New Jersey.
2. Earth Reinforcement and Soil structures by Jones C. J. P, Butterworth's, London.
3. Ground Control and Improvement by Petros Xianthakos, Lee W. Abramson, Donald A. Bruce.





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## (PE III) - BRIDGE ENGINEERING - D16PE3

VI Semester

L/T/P/C

3/0/0/3

### PRE-REQUISITES:

Structural Analysis, Reinforced Cement Concrete, Design of Steel Structures

**COURSE OBJECTIVES:** The Objective of this Course is to

1. Introduce the theory and application of analysis and design of reinforced concrete and steel bridges.
2. Designing and understanding the structural behaviour of reinforced concrete and steel components of highway and railway bridges subjected to static and dynamic loads.
3. To carry out of design of bridge starting from conceptual design, selecting suitable bridge geometry to sizing of its elements.

**COURSE OUTCOMES:** After learning the course, the students should be able

1. To develop an understanding of appreciation for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.
2. To understand the load carrying capacity of various types of bridges with different kinds of loads.
3. To understand and appreciate significance of bridge engineering in different fields of engineering.
4. To carry out design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements.
5. To understand the load flow mechanism and identify loads on bridges.

### UNIT-I

Introduction - Types of Bridges, Economic Spans, Aesthetics, and Selection of Suitable type of Bridge.

### UNIT-II

Design Loads and their Distribution, IRC Loads, Railway Loading, Analysis of Deck Slab and IRC Loads, Load Distribution among Longitudinal Beams of a Bridge.

### UNIT-III

Design of Superstructures - Design of Balanced Cantilever Concrete Bridge, Introduction to Design of RC Arch Bridge, Prestressed Concrete and Box Girder Bridge. Design of Lattice Girder Railway Bridge.

### UNIT-IV

Design of Substructure - Different types of Foundations, their choice and method of Construction, Design of Well Foundation, Design of Piers and Abutments, Various Types of Bearings and their Design.

### UNIT-V

Construction Methods - Erection of bridge Superstructures, Cantilever Construction.



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## TEXT BOOKS:

1. Design of Bridges by N Krishna Raju, Oxford & IBH.
2. Principles and Practice of Bridge Engineering S.P. Bindra, Dhanpat Rai Publications.
3. Bridge Engineering by Ponnuswamy S, Tata McGraw Hill.
4. Concrete Bridge Practice by Raina V K, Tata McGraw Hill.
5. Essentials of Bridge Engineering by Jhonson D Victor, Oxford & IBH.

## REFERENCE BOOKS:

1. Design of Concrete Bridges by M.G. Aswani and V.N. Vazirani and MM Ratwani, Khanna Publishers.
2. Bridge Deck Behavior by E C Hambly, CRC Press.
3. Design of Bridges by VV Sastry, Dhanpat Rai & Co.
4. Concrete Bridge Design and Practice by VK Raina
5. IRC 6, 22, 24: Standard Specifications and Code of Practice for Road Bridges.
6. IRC 112-2011: Code of Practice for Concrete Road Bridges.
7. IS 456-2000: Plain and Reinforced Concrete - Code Practice.



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## BUSINESS ECONOMICS AND FINANCIAL ANALYSIS - D6HSBF

VI Semester

L/T/P/C

3/0/0/3

### COURSE OBJECTIVES:

1. To learn the basic business type of the organization.
2. To acquire the knowledge and impact of the economy on business firms.
3. To analyze the business from the financial perspective.
4. To know the financial position of the company.
5. To predict the future of business

### COURSE OUTCOMES:

1. Analyze the total structure of the business and able to identify and classify the different types of business entities.
2. Assess the demand and supply analyses with the help of various measures and types of Elasticity of demand.
3. Infer the knowledge about production and cost analysis for product and services.
4. Interpret the fundamental concepts related to financial accounting.
5. Predict the financial position by analyzing the financial statement of the company through various ratios.

### UNIT – I

#### Introduction to Business and Economics:

**Business:** Define Business, characteristics of business, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company.

**Economics:** Significance of Economics, Micro and Macro Economic Concepts, and Importance of National Income, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist.

### UNIT – II

#### Demand Analysis:

**Elasticity of Demand:** Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Steps in Demand Forecasting, Methods of Demand Forecasting.

### UNIT- III

#### Production, Cost, Market Structures & Pricing:

**Production Analysis:** production function, Law of returns to scale, Internal and External Economies of Scale.

**Cost analysis:** Cost concepts, Types of Costs. Break-even Analysis (BEA)

**Pricing:** Types of Pricing, product life cycle, **GST (Goods & service Tax)**

**Market Structures-** Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition, oligopoly.



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## UNIT - IV

**Financial Accounting:** Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

## UNIT - V

**Financial Analysis through Ratios:** Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

## TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.
4. Rakesh Garg, Sandeep Garg, Hand Book of GST in India
5. A.R. Aryasri (2011), Managerial Economics and Financial Analysis, TMH, India.

## REFERENCES BOOKS:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.



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## SOIL MECHANICS LAB – D16PC23

VI Semester

L/T/P/C

0/0/2/1

**PRE-REQUISITES:** Soil Mechanics.

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

1. Determine the Various Properties of Soils by using Different Lab Tests.
2. Determine the Index Properties of Soil and classify them.
3. Determine Compaction & Consolidation of Soils.
4. Determine Permeability and Shear Strength Characteristics of Soil

### LIST OF EXPERIMENTS:

1. Determination of Specific Gravity of Soil by Pycnometer.
2. Determination of Field Density by Core Cutter and Sand Replacement Methods.
3. Grain Size Distribution by Sieve Analysis.
4. Determination of Atterberg's Limits.
5. Permeability of Soil by Constant Head Test Method.
6. Permeability of Soil by Variable Head Test Method.
7. Determination of Compaction by Standard Proctor's Test.
8. Direct Shear Test for Cohesion less Soils.
9. Vane Shear Test for Cohesive Soils.
10. Demonstration on Unconfined Compression Test for Clayey Soils.
11. Demonstration on Differential Free Swell Index (DFSI) Test.
12. Demonstration on Determination of Coefficient of Consolidation.

### REFERENCE BOOKS:

1. Laboratory Manual on Soil Mechanics (Testing and Interpretation) by Ravi Kumar Sharma.
2. IS 2720: Code for Geotechnical Engineering Lab Manual by William K. Kitch, Kendall/Hunt Publishing Co, U.S.



# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

AN AUTONOMOUS INSTITUTION

Accredited by NBA and NAAC with A+ Grade

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Medbowli, Meerpet, Balapur, Hyderabad, Telangana – 500097



## GEOGRAPHIC INFORMATION SYSTEM LAB – D16ESGL

VI Semester

L/T/P/C

0/0/2/1

**PRE-REQUISITES:** Surveying, Remote Sensing & GIS Concepts

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

1. Familiar with Concepts of GIS, Graphical User Interface of QGIS Software.
2. Do geo-referencing of maps and will be familiar with the topographic maps.
3. Develop different thematic maps like drainage map, and land use/land cover map.
4. Understand Various Pluggins, Create attribute table(s), Create Print Layout, Create Digital Terrain Model (DTM).
5. Develop Solutions to the field problems using QGIS software.

GIS SOFTWARE USED: QGIS

**List of Experiments: (Any 10 experiments)**

1. Introduction to GIS, Concepts and Terminology, GIS Processes etc.
2. Introduction to QGIS Software: User Interface Operations, Features etc.
3. Geo-referencing of Toposheets/images.
4. Image Enhancements of Satellite image.
5. Raster Mosaicking and Clipping.
6. Digitization of Maps/Toposheets.
7. Creation of Thematic Maps.
8. Using Pluggins and downloading Open Street Map (OSM) data.
9. Working with attributes.
10. Unsupervised Classification
11. Supervised Classification
12. Map Composition.
13. DEM Creation.
14. Creation of Print Layout.

**TEXT BOOKS:**

1. Geographic Information Systems: A Management Perspective by Aronoff, Stanley.
2. Concepts and Techniques of Geographic Information Systems by Lo, C.P. & Yeung A.K.W., Prentice Hall (India).
3. Principles of Geographical Information Systems by Burrough, P.A., Oxford Publications.
4. QGIS Training Manuals from <https://qgis.org/en/docs/index.html>