



# **III YEAR I SEMESTER**



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY  
GEOTECHNICAL ENGINEERING**

**Course Code:GR22A3001**

**L/T/P/C:2/0/0/2**

**III Year I Semester**

**Prerequisites:** Engineering Geology

**Course Outcomes:**

1. Identify basic Engineering properties of soil and classify the soil.
2. Evaluate coefficient of permeability and effective stresses of soil.
3. Assess the mechanism of stress distribution and compaction in soils.
4. Analyze the behaviour of soil during consolidation process.
5. Evaluate the performance of shear strength of soil mass.

**UNIT I**

**Introduction** - Types of soils and their formation, Scope of soil mechanics, Basic definitions and relationships, Soil mass as two and three-phase system, Relative Density, Consistency limits, Consistency indices, Grain size analysis, Indian standard soil classification system and Plasticity chart.

**UNIT II**

**Permeability of Soil** – Capillary rise, Darcy's law, determination of coefficient of permeability by constant-head method and falling-head method. Field methods by pumping-out test. Permeability of stratified soils and factors affecting permeability of soil.

**Seepage Analysis** - characteristics of flow nets, total stress, neutral stress and effective stress. Principle of effective stress, effect of water table and fluctuations in effective stress, quicksand condition.

**UNIT III**

**Stresses in soils** – Introduction, Pressure bulb and Isobars, Boussinesq's equation for the vertical stress due to point load, line load, strip load, uniformly loaded circular area. Representation of stress along the vertical plane and horizontal plane. Westergaard's equation, Theory of Newmark's Influence Chart. Appropriate stress distribution methods - equivalent point load method and two to one method.

**Compaction of Soil** – Mechanism of compaction, laboratory tests, factors affecting compaction, effects of compaction on soil properties, Field compaction and quality control.

**UNIT IV**

**Consolidation of Soil** – stress history of clay, primary consolidation, and secondary consolidation settlement, Terzaghi's theory of consolidation, interpretation of consolidation test results, determination of pre-consolidation pressure.

**UNIT V**

**Shear Strength** - Mohr circle and its characteristics, Mohr-Coulomb theory. Types of laboratory shear tests – direct shear test, tri-axial compression test, unconfined compression test and vane shear test. Shear strength of clays and sands.

**Text Books**

1. Gopal Ranjan and ASR Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd, New Delhi, 3rd edition (2016).
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, 5th edition (2000), Reprint (2020).
3. C. Venkataramiah, Geotechnical Engineering, New age International publishers (2002), 5th edition (2017).

**Reference Books**

1. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundations, Laxmipublications Pvt. Ltd., New Delhi, 16th edition, Reprint (2017).
2. Dr. P. Purushotham Raj, Soil Mechanics and Foundation Engineering, Pearson Education India (2008).
3. S. K. Gulhati & Manoj Datta, Geotechnical Engineering, Mc.Graw Hill Education Pvt Ltd., New Delhi (2005), Reprint (2017).
4. Braja M. Das, Advanced Soil Mechanics, Taylor and Francis, 4th edition (2013).
5. Soil Mechanics by Craig R.F., Chapman & Hall, 8th edition 2012, CRC Press.
6. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri-Wiley Inter science, 3rd edition- 1996.
7. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy, Publishers: Marcel Dekker, 2010.



## GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY CONCRETE TECHNOLOGY

**Course Code: GR22A3002**  
**III Year I Semester**

**L/T/P/C:2/0/0/2**

**Prerequisites:** Building Materials and Construction Planning

**Course Outcomes:**

1. Explain the physical and chemical properties of concrete ingredients and able to conduct tests on cement.
2. Explain the physical and chemical properties of aggregates and able to conduct tests on aggregates.
3. Comprehend the behaviour of fresh & hardened concrete.
4. Demonstrate different tests on hardened concrete and estimate the creep and shrinkage of concrete.
5. Design the mix proportions for the specific work for required strength and workability with available materials at workplace and discuss the applications of the special concretes.

**UNIT – I**

**Cements & Admixtures:** Portland cement – Chemical composition – Hydration, setting of cement – Structure of hydrated cement – Tests on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

**UNIT – II**

**Aggregates:** Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum size of aggregate.

**UNIT - III**

**Fresh Concrete:** Manufacturing of concrete, mixing, compaction curing, Properties of fresh concrete. Workability – Factors affecting workability – Measurement of workability – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding.

**Hardened Concrete:** Water / Cement ratio – Abram's Law – Gel Space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength -Durability of Concrete.

**UNIT - IV**

**Testing of Hardened Concrete:** Compression tests – Tension tests – Factors affecting strength – Flexure tests – Splitting tests – Non-destructive testing methods – Codal provisions for NDT – Quality control of Concrete.

**Elasticity, Creep & Shrinkage:** Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – Types of shrinkage.

**UNIT - V**

**Concrete Mix Design:** Factors in the choice of mix proportions – Acceptance criteria – Proportioning of concrete mixes by BIS method of mix design.

**Special concretes:** Lightweight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre Reinforced concrete – Different types of fibres – Factors affecting properties & Applications of F.R.C – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete & Applications – High performance concrete – Self-consolidating concrete – SIFCON – Geopolymer Concrete.



**Text Books:**

1. Concrete Technology: Theory and Practice, M. S. Shetty and A. K. Jain, S Chand Co., Publishers 2018.
2. Concrete Technology by M.L. Gambhir – Tata Mc. Graw Hill Publishers, 5<sup>th</sup> edition 2017 New Delhi.
3. Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta, Paulo J. M. Monteiro, McGraw Hill Professional, 2013

**Reference Books:**

1. Properties of Concrete, AM Nevelli, Prentice Hall Publishers, 2012, 5<sup>th</sup> edition.
2. Concrete Technology and Good Construction Practices by Y P Gupta, New Age International Private Ltd. 1<sup>st</sup> edition 2013.
3. Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi-2006.
4. Concrete: Microstructure, Properties and materials by P Kumar Mehta, P J M Monteiro, MC Graw Hill Education Publisher, New Delhi- 4<sup>th</sup> edition-2017.
5. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House 2015.
6. Concrete Technology by S.S Bhavikatti, I K International Publishing House 2015.

**IS CODES:**

1. IS 10262: 2019, Concrete Mix Proportioning- Guidelines (Second Revision).
2. IS 383: 2016 Coarse and Fine Aggregate for Concrete – Specification
3. IS 516: Method of Tests for Strength of Concrete.



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY  
HYDROLOGY AND WATER RESOURCES ENGINEERING**

**Course Code:GR22A3003**

**L/T/P/C:3/0/0/3**

**III Year I Semester**

**Pre-Requisites:** Introduction to Fluid Mechanics

**Course Outcomes:**

1. Measure, estimate and process rainfall data, runoff data, evaporation data, Evapotranspiration data and infiltration data.
2. Design a model in a region for direct run off hydrograph, unit hydrograph, S-Curve hydrograph, and Synthetic unit hydrograph.
3. Calculate the discharge of radial flow to wells in a region of confined and unconfined aquifers by determining the aquifer parameters by field tests and pumping tests.
4. Design a suitable irrigation method depending on soil, water and plant conditions on the field & Prepare irrigation schedules and irrigation efficiencies for farmers on the field
5. Design irrigation canals and estimate discharge by SCS Curve Number Method, analyze the regional flood frequency, discuss the methods of stream gauging and evaluate the forces acting on gravity dam.

**UNIT I**

**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 over a Catchment-Empirical and Rational Formulae.

Abstraction from rainfall: Evaporation, factors effecting Evaporation, Measurement of evaporation– Evapotranspiration-Penman and Blaney & Criddle Methods -Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices- Important aspects of National Water Policy 2012.

**UNIT II**

**Distribution of Runoff:** Hydrograph Analysis; Flood Hydrograph – Effective Rainfall - Base Flow- Base Flow Separation - Direct Runoff Hydrograph– Unit Hydrograph, definition and limitations of application of Unit hydrograph, Derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa S- Curve hydrograph, Synthetic Unit Hydrograph

**UNIT III**

**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**

**Necessity and importance of irrigation:** Advantages and ill-effects of irrigation, Types of irrigation, Methods of application of irrigation water, Indian Agriculture soils, Methods of improving soil fertility-Crop rotation, preparation land for irrigation, Standards of quality for irrigation water.

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. The depth and frequency of Irrigation, Irrigation efficiencies- Water Logging.

**UNIT V**

**Classification of canals:** Design of Irrigation canals by Kennedy's and Lacey's theories, balancing



depth of cutting, IS standards for canal design canal lining.

Design discharge over a catchment: computation of design discharge–Rational formula, SCS curve number method, flood frequency analysis introductory part only. Stream gauging- measurement and estimation of stream flow.

Dams: Types of Reservoirs, Dams and Spillways. Stability Analysis on Gravity Dams and Earthen Dams. Very Basic Concepts only in Water Data visualization and extraction from India- WRIS (Water Resources Information Systems) and BHUVAN-Names and Numbers of ten important IS codes in Water Resources Engineering- Listing only Software Applications to WRE- Listing only

### Text Books

1. A Text book of Hydrology by P. Jaya Rami Reddy, 3<sup>rd</sup> Edition, Laxmi publications, 2016.
2. Engineering Hydrology by K. Subramanya, Fourth Edition, McGraw Hill Education, 2017.
3. Irrigation and Water Power Engineering- B.C.Punmia, Pande B.B.Lal, Ashok Kumar Jain, Arun Kumar Jain-Laxmi Publications, 17th edition- 2021.

### Reference Books

1. Irrigation Engineering & Hydraulic Structures- Santosh Kumar Garg, first edition 2006.
2. Elementary Hydrology by V.P.Singh, PHI publications, Fascimile edition-1991
3. Irrigation and Water Resources & Water Power by P. N. Modi, Standard Book House, 11<sup>th</sup> edition 2019.
4. Irrigation Water Management by D.K. Majumdar, Prentice Hall of India., 2<sup>nd</sup> edition-2013.
5. Applied Hydrology by Ven Te Chow, David R Maidment, Larry W Mays, Tata Mc Graw Hill Education, first edition 2017.
6. Introduction to Hydrology by Warren Viessman, Jr. Garyl Lewis- Pearson, 5<sup>th</sup> edition 2003.
7. NPTEL Web and Video Courses.
8. HEC-HMS (hec.usace.army.mil/software/hec-hms/features.aspx)
9. MODFLOW (usgs.gov/mission-areas/water-resources)
10. SWAT (swat.tamu.edu)
11. India –WRIS ([www.indiawris.gov.in](http://www.indiawris.gov.in))
12. BHUVAN (bhuvan.nrsc.gov.in)
13. Handbook of Hydrology–Edited by David R. Maidment, MC Graw Hill Education, 1992.
14. Handbook of Applied Hydrology -Edited by V.T.Chow, Mc Graw Hill education, 1964.
15. Groundwater Hydrology– David K. Todd and Larry W. Mays Wiley 3<sup>rd</sup> Edition-2005.



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
**DESIGN OF REINFORCED CONCRETE STRUCTURES**

**Course Code:GR22A3004**

**L/T/P/C: 2/1/0/3**

**III Year I Semester**

**Prerequisite:** Solid Mechanics, Structural Analysis, Building Materials and Construction Planning and Engineering Graphics.

**Course Outcomes:**

1. Summarize the basic design concepts.
2. Evaluate the behaviour and design of RC member under flexure, shear, torsion, and bond.
3. Evaluate the behaviour and design of slabs, staircase, and canopy.
4. Evaluate the behaviour and design of columns.
5. Evaluate the behaviour and design of footings and salient features of limit state of serviceability.

**UNIT I**

**Concepts of R.C Design:** Study of the strength, behaviour, and design of indeterminate reinforced concrete structures. Loads and stresses, load combinations. Working stress method and limit state approach as per IS-456-2000. Analysis and design of singly and doubly reinforced rectangular beams.

**UNIT II**

**Analysis and Design of Beams:** Analysis and design of singly and doubly reinforced Flanged sections using limit state method. Design for shear, torsion and bond using limit state concept. Mechanism of shear and bond failure. Development length of bars; I.S. code provisions design examples in simply supported and continuous beams with detailing.

**UNIT III**

**Design of Slabs:** Design of two-way slab and one way slab using I S coefficients. Placement of reinforcement in slabs. Design of flat slab. Design of Staircase and Canopy (portico).

**UNIT IV**

**Design of Columns:** Design of Short columns, columns with uni-axial and bi-axial bending. Design of long columns, use of design charts - I S code provisions.

**UNIT V**

**Design of Foundation:** Wall footing, Isolated and combined footing for columns. Limit state design of serviceability for deflection, cracking and codal provisions.

**Text Books**

1. Limit State design by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jai, Laxmi publication Pvt. Ltd., New Delhi, 2016. Revised edition
2. Limit State Design of Reinforced Concrete by P.C. Varghese, 2nd Edition, PHI, New Delhi, 2011
3. Fundamentals of reinforced concrete design by M.L.Gambhir, Prentice Hall of India Private Ltd.,2010, New Delhi. 1<sup>st</sup> Edition,





### Reference Books

1. Reinforced concrete structural elements-behavior, analysis and design by Purushotam, Tata Mc.Graw Hill, New Delhi, 1984.
2. Design of Reinforced Concrete Structures by N.Subramaniyan. Oxford University Press.
3. Reinforced Concrete Design by S. Unnikrishna Pillai & Devdas Menon, 3rd Edition, TMH, NewDelhi, 2009.
4. Reinforced Concrete Design by N. Krishna Raju and R.N. Pranesh, 8th Edition, New Age International, New Delhi, 2004.
5. Design of Reinforced Concrete Structures by I. C. Syal and A. K. Goel, S. Chand & company.
6. Reinforced Concrete by H J Shah. Charotar Publishing House Pvt. Limited. 12<sup>th</sup> Edition.
7. Design of concrete structures by J.N. Bandhyopadhyay PHI Learning Private Limited.

### CODE BOOKS:

1. IS 456-2000; Indian Standard Code of Practice for Plain and Reinforced Concrete.
2. SP 16: Design Aids for Reinforced Concrete



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
**STRUCTURAL ANALYSIS-II**  
**(PROFESSIONAL ELECTIVE - I)**

**Course Code:GR22A3005**  
**III Year I Semester**

**L/T/P/C: 3/0/0/3**

**Pre-requisites:** Solid Mechanics, Structural Analysis -I

**Course Outcomes:**

1. Analyze various types of frames with and without sway using Slope deflection and Moment distribution methods.
2. Analyze various types of frames using Kani's methods of Analysis.
3. Evaluate the shear forces, bending moments and axial forces in beams, columns and at joints of multi-storey frames using approximate methods of analysis.
4. Analyze the simple beams and frames using stiffness matrix and flexibility matrix methods of analysis.
5. Apply the principles of virtual work to estimate the collapse load and plastic moment carrying capacity of simple beams and frames.

**UNIT I**

Analysis of building frames- Slope deflection and Moment Distribution Methods of analysis to simple portal frames without and with sway- frames with inclined legs.

**UNIT II**

Analysis of building frames- Kani's Method for analysis of continuous beams and Portal frames (up to single bay two storeys).

**UNIT III**

Approximate method of Analysis: Frames with vertical loads using Substitute frame method – Frames with horizontal loads using Portal and Cantilever methods

**UNIT IV**

Matrix method of analysis: Static and Kinematic indeterminacies- different approaches to matrix methods- analysis using stiffness matrix methods for beams and frames (3 DOF) and flexibility matrix methods for beams and frames (2 DOF)

**UNIT V**

Plastic analysis: Concepts - Plastic hinges- mechanism- -Shape factors- upper and lower bound theorem- Plastic analysis for simple beam and simple portal frames

**Text Books**

1. Theory of structures - B.C.Punmia, Jain, Ashok Kumar Jain & Arun Kumar Jain, Laxmi publications, 13<sup>th</sup> edition-2017.
2. Indeterminate Structural Analysis - K.U. Muthu, H. Narendra, Maganti Janardhana, M. Vijayanand – I K International Publishing House Pvt. Ltd., 2014.
3. Structural Analysis 1 and II 4/e – S S Bhavikatti, Vikas Publishing House, 4<sup>th</sup> edition, 2013



### Reference Books

1. Advanced Structural Analysis - Devdas Menon, Narosa Publishing House Pvt Ltd, Edition 2015.
2. Analysis of structures-T.S.Thandava Moorthy, Oxford University Press.
3. Structural Analysis –Devdas Menon -Alpha Science International Ltd., 2007.
4. Advanced Structural Analysis - Devdas Menon - Narosa Publishers, 2009.
5. Wang C.K., “ Indeterminate Structural Analysis”, Tata McGraw Hill Education Pvt. Ltd., NewDelhi, 2010
6. William Weaver Jr. & James M. Gere, "Matrix Analysis of Framed Structures", CBS Publishers and Distributors, Delhi, 2004.



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
**TRAFFIC ENGINEERING AND MANAGEMENT**  
**(PROFESSIONAL ELECTIVE - I)**

**Course Code: GR22A3006**

**L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Course Outcomes:**

1. Solve traffic problems and evaluate its characteristics.
2. Plan various traffic surveys and demonstrate the solutions.
3. Show traffic regulation and control measures at intersection.
4. Illustrate basic traffic signal phasing and timing plan.
5. Demonstrate Traffic management Systems.

**UNIT-I**

**Traffic Planning and Characteristics-** Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow. Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics

**UNIT- II**

**Traffic Surveys and Analysis -** Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of Service – Concept, applications, significance.

**UNIT -III**

**Intersections -** Conflicts at Intersections, Classification of Intersections at Grade, - Channelized and Unchanallised Intersection - Grade Separated Intersections-Concept and layout, Principles of Intersection Design, Elements of Intersection Design, Rotary Intersection, and elements.

**UNIT IV**

**Traffic Control-**Traffic signs- Road markings - Traffic signal design using Websters method and IRC method - Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design.

**UNIT V**

**Traffic Management-** Traffic System Management (TSM) and Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes - Introduction to Intelligence Transport System (ITS)

**Text Books**

1. Khanna, S.K, Justo, A and Veeraragavan, A, ‘Highway Engineering’, Nem Chand & Bros. Revised 10th Edition, 2014
2. Kadiyali L.R. and Lal N B, Principles and Practices of Highway Engineering; Seventh Edition, First Reprint; Khanna Publishers, New Delhi, 6<sup>th</sup> edition 2018
3. Kadiyali L R, Traffic Engineering and Transport Planning, Khanna Technical Publications, Delhi, 8<sup>th</sup> edition, 2000.



### Reference Books

1. Khisty C J and Lall B Kent; Transportation Engineering: An Introduction, Third Edition, 1st Indian Adaptation; Pearson India Education Service Pvt. Ltd, New Delhi 2017.
2. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management.
3. Guidelines of Ministry of Road Transport and Highways, Government of India. 2020
4. Subhash C. Saxena, A Course in Traffic Planning and Design, Dhanpat Rai Publications, New Delhi, 6<sup>th</sup> edition 1989.  
Papacoastas, C. S. and Prevedouros, Transportation Engineering and Planning, Third Edition, Third Impression; Pearson Education, 2018.



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
**SURFACE HYDROLOGY**  
**(PROFESSIONAL ELECTIVE - I)**

**Course Code: GR22A3007**

**L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Pre-Requisites:** Hydrology and Water Resource Engineering

**Course Outcomes:**

1. Examine the different types of hydrology definitions.
2. Evaluate the consumptive use, infiltration, and evaporation.
3. Compute the runoff discharges in streams and rivers.
4. Illustrate the application of hydrographs by computing rainfall and run off.
5. Examine the flood estimation by various methods.

**UNIT I**

**Introduction:** Hydrology- definition, Surface and ground water hydrology, Hydrologic cycle- Precipitation, Evaporation, Infiltration, Rain-gauges, Mass rainfall curve, characteristics, Mean rainfall on a basin-Arithmetic, Thiessen and Isohytol Methods, Intensity-duration analysis, Intensity-frequency-duration analysis, depth-area- duration curves, estimation of missing rainfall data, consistency of rainfall records- double mass curves, rain-gauge network analysis.

**UNIT II**

**Evaporation & Infiltration:** Evaporation process, Factors affecting, estimation, measurement of Evaporation, Evaporation pans, Transpiration, Evapotranspiration, PET, Consumptive use Lysimeter, formulae for estimating PET. Infiltration process, factors affecting, measurement of infiltration, infiltrometers, infiltration capacity curve, Horton's Relation, Infiltration Indices.

**UNIT III**

**Stream flow and Runoff:** Measurement of stage, measurement of velocities-surface floats, velocity rods and current meter, measurement of discharge in a river, stage- discharge relation, extension of stage- discharge curves, selection of site for stream- discharge gauging. Components of Runoff - factors affecting and estimation of runoff - basin yield - flow duration

**UNIT IV**

**Hydrographs:** Hydrograph-components, separation of hydrograph into base flow, and DRO methods, Unit Hydrograph-principles, derivation of UH of Isolated unit storms, UH for various durations, S-curve technique. Estimation of runoff from UH, limitations of UH theory, Synthetic UH, IUH.

**UNIT V**

**Design Flood:** Maximum flood and design flood, estimation of flood- different methods, flood frequency analysis- probability table, different plotting positions, Gumble's extreme value theory, Log Pearson type-III analysis, selection of design flood. Flood routing: Flood Routing through reservoirs- Puls method and modification plus method. Channel routing-Muskinghum method, derivation of routing equations, Goodrich method.

Flood Control: Flood control measures, flood control through reservoirs, channel improvements, Bank protection measures, Flood fighting, flood proofing, flood forecasting and flood warning.



### **Text Books**

1. “A textbook of Hydrology”, P. Jayaram Reddy, 3rd edition, 2011, Laxmi Publications, New Delhi. 2021 latest edition
2. “Engineering Hydrology”, K Subramanya, 4th edition, Tata-Mc Graw Hill Publishing company limited, New Delhi, 2021.
3. “Hydrology”, Madan Mohan Das, Mim Mohan Das, PHI Learning Private Ltd., New Delhi, 2022.

### **Reference Books**

1. “Hydrology”, by, Elements of Engineering Hydrology by V.P. Singh (Tata McGraw-Hill)
2. “Engineering Hydrology”, EM Wilson, The Mac millan press limited. 2021
3. “Hydrology”, H M Raghunath, New Age International Pvt Ltd, 8th edition, 2022
4. “Introduction to Hydrology”, W. Viessman Jr. & G L Lewis, Harper & Row Publications, 2<sup>nd</sup> edition 2021
5. Handbook of Applied Hydrology, Second Edition by VP Singh · 2017.



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
**PAVEMENT MATERIALS**  
**(PROFESSIONAL ELECTIVE - I)**

**Course Code: GR22A3008**  
**III Year I Semester**

**L/T/P/C: 3/0/0/3**

**Course Outcomes:**

1. Characterize the soil based on the geotechnical properties and justify the applicability.
2. Analyze the engineering properties of aggregates and customizing for application under various field situations.
3. Characterize the binder based on the properties and justify the applicability.
4. Apply appropriate mix design in flexible pavement construction depending upon the traffic and climatic conditions.
5. Demonstrate the utility of Advanced and alternative pavement materials.

**UNIT I**

**Subgrade Soil Characterization:** Different types of soils, Mechanical response of soil; Properties of subgrade layers; Suitable lab and field tests-, CBR, Sieve analysis, Field Density; Suitability of different type of soil for the construction of highway embankments and pavement layers Field compaction and control.

**UNIT II**

**Aggregate Characterization:** Origin, Classification, Types of aggregates; Sampling of aggregates; Mechanical and shape properties of aggregates, Aggregate texture and skid resistance, polishing of aggregates; Proportioning and Blending of aggregates: Super pave gradation; Use of locally available materials in lieu of aggregates.

**UNIT III**

**Binder Characterization: Bitumen-** Origin, preparation, properties and tests, constitution of bituminous road binders; requirements; Criterion for selection of different binders.

**Cement** - Production of cement; Types of cements and basic cement; Physical and chemical properties of cement, Special cements; Quality tests on cement.

**UNIT IV**

**Bituminous Mixes:** Mechanical properties: Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes. Weathering and Durability of Bituminous Materials and Mixes, bituminous mix design methods and Specifications. Performance based Bitumen Specifications: Introduction to Superpave mix design.

**UNIT V**

**Advanced Paving Materials:** Recycled aggregates, geosynthetics, industrial wastes – characterization. recycled and waste materials (green materials), Recycled asphalt pavement (RAP) material. Bituminous emulsion and Cutbacks, Crum rubber, and rubber modified bitumen and anti-Stripping agents on pavement performance. Pozzolanic and geopolymer materials as alternate cement

**Text Books**

1. Soil Mechanics and Foundation Engineering- K.R. Arora, Standard Publishers Distributors, Delhi (2005).
2. Highway Engineering - S.K. Khanna & C.E.G. Justo, Nemchand & Bros, edition 2020.
3. Highway Materials testing– S.K. Khanna & C.E.G. Justo. Nem Chand & Brothers,2013.





### Reference Books

1. Concrete Technology by M.S.Shetty. – S.Chand & Co. ; 2004
2. Principles of Pavement Design – E. J. Yoder, M. W. Witzak,1991.
3. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall.
4. Das, A. And Chakroborty, P. Principles of Transportation Engineering, 1st Edition, PHI Publication (2017).



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY  
GEOTECHNICAL ENGINEERING LAB**

**Course Code: GR22A3010**  
**III Year I Semester**

**L/T/P/C: 0/0/4/2**

**Pre- Requisites:** Geotechnical Engineering

**Course Outcomes:**

1. Identify the soil behaviour and its mechanism.
2. Interpret basic properties of soil in simple and complex applications.
3. Develop proficiency in handling experimental data.
4. Excel in experiment research and to succeed with real time projects.
5. Propose extensive research in experimental methods and geotechnical designs.

**List of experiments:**

- Task1:** Liquid limit and plastic limit
- Task2:** Grain size distribution by sieve analysis
- Task3:** Field density by core cutter method
- Task4:** Field density by sand replacement method
- Task5:** Relative density of sands
- Task6:** Standard and modified compaction test
- Task7:** Permeability of soil by constant and variable head test
- Task8:** California Bearing Ratio Test
- Task9:** Consolidation test
- Task10:** Unconfined compression test
- Task11:** Direct shear test
- Task12:** Vane shear test
- Task13:** Tri-axial test (Demonstration)

**Reference Books**

1. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, 5<sup>th</sup> edition (2000), Reprint (2009).
2. C.Venkataramiah, Geotechnical Engineering, New age International publishers (2002),6th edition (2018).
3. AlamSingh, "Soil Engineering Theory and Practice" Voll: Fundamentals & General Principles, Vol 2: Geotechnical Testing & Instrumentation,
4. Murthy, V. N.S., "Principles of Soil Mechanics and Foundation Engineering" CBS Publisher distributors Pvt. Ltd. Delhi.



**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY  
CONCRETE TECHNOLOGY LAB**

**Course Code: GR22A3011**

**L/T/P/C: 0/0/4/2**

**III Year I Semester**

**Pre-Requisites:** Concrete Technology

**Course Outcomes:**

1. Identify the suitable materials used for concrete for particular purpose.
2. Interpret the quality control of Cement and concrete.
3. Identify, describe, and carry out the main laboratory tests relevant to the use of concrete onsite.
4. Design normal concrete mixes.
5. Interpret the properties in tern to design or invent the new materials.

**List of Experiments:**

1. Normal Consistency test on cement
2. Initial Setting time and final setting time of cement
3. Fineness test of cement
4. Specific gravity of cement
5. Soundness test of cement
6. Compressive strength of cement
7. Sieve analysis of Coarse and fine aggregate
8. Bulking of sand (Field test & Laboratory Test)
9. Workability test on concrete using slump Cone
10. Workability test on concrete by compaction factor test
11. Workability test on concrete by Vee-Bee Test
12. compressive strength of concrete
13. Split tensile strength test on concrete.

**Reference Books**

1. Concrete Technology Theory and Practice, Shetty M. S, S. CHAND, 8th edition, 2019.
2. Concrete Technology: Theory and Practice Gambhir Murari Lal, Mcgraw Hill, fifth edition., 2013.
3. IS 269:2013 – Ordinary Portland cement, 33 grade- Specification (Fifth Revision)
4. IS 383:2016 – coarse and fine aggregates for concrete- Specification (Third Revision)
5. IS 10262 :2019, Concrete Mix Proportioning- Guidelines (Second Revision).

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY  
CONSTITUTION OF INDIA****Course Code: GR22A2003****L/T/P/C: 2/0/0/0****III Year I Semester****Course Outcomes**

1. Students will be able to know the importance of Constitution and Government
2. Students will be able to become Good Citizens and know their fundamental rights, duties, and principles.
3. Students will learn about the role of PM, President, Council of Ministers etc and it will help students learn about Local Administration.
4. The students understand the importance of Election Commission and the Students will become aware of how a Country and State are run in Democracy.
5. They will know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.,

**UNIT I**

**Introduction: Constitution'** meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

**UNIT II**

**Union Government and its Administration:** Structure of the Indian Union: Federalism, Centre - State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

**UNIT III**

**State Government and its Administration:** Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure 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, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials.

**UNIT V**

**Composition of Judiciary and Election Commission:** Composition of Indian Judiciary, 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.

**Books Recommended:**

1. 'Indian Polity' by Laxmikanth 5<sup>th</sup> Edition, McGraw Hill Edition.
2. Indian Constitution by Subhash C. Kashyap, Vision Books Publisher
3. 'Introduction to Indian Constitution' by D.D. Basu, 21<sup>st</sup> Edition, LexisNexis Publisher
4. 'Indian Administration' by Avasthi and Avasthi-by lakshminarainagarwal publication.