

B.Tech Curriculum for Civil Engineering

SEMESTER -III

Subject Name	Type	Course Code	L-T-P	Credit	Contact Hours
	HSS 2		3-0-0	3	3
Mechanics of Solids	DC1	CE2L101	3-0-0	3	3
Hydraulics	DC2	CE2L102	3-0-0	3	3
Geology and Soil Characterization	DC3	CE2L103	3-0-0	3	3
Introduction to Transportation Engineering	DC4	CE2L104	3-0-0	3	3
Geomatics Practices	SDC 1	CE2L105	2-0-2	3	4
Hydraulics Laboratory	Lab-1	CE2P101	0-0-3	2	3
Total				20	22

SEMESTER-IV

Subject Name	Type	Course Code	L-T-P	Credit	Contact Hours
	HSS 3		3-0-0	3	3
Structural Analysis-I	DC5	CE2L106	3-0-0	3	3
Water Resources Engineering	DC6	CE2L107	3-0-0	3	3
Soil Mechanics	DC7	CE2L108	3-0-0	3	3
Construction Materials	SDC 2	CE2L109	2-0-2	3	4
OE-1	OE	OE	3-0-0	3	3
Geotechnical Engineering Laboratory	Lab-2	CE2P102	0-0-3	2	3
Transportation Engineering Laboratory	Lab-3	CE2P103	0-0-3	2	3
Total				22	25

Syllabus for 2nd Year (3rd & 4th Semesters)

Subject Code: CE2L101	Name: Mechanics of Solids	L-T-P-C: 3-0-0-3
Prerequisite: None		
Module 1: (12 hours) Stress strain behavior of engineering materials, Concept of stress and strain field, stress tensor, stress-strain transformation, stress invariants, Temperature Stress and Strain, Mohr's Circle for plane stress and plane strain, Relations between Elastic Constants, Hook's law and compatibility conditions, differential equation of equilibrium. Different theories of failure. Module 2: (10 hours) Shear Force and Bending Moment Diagrams, Energy methods, Bending analysis, Composite section analysis, Combined Bending and Direct Stresses, Shear Stress Distributions. Module 3: (8 hours) Torsion of circular members and thin-walled tubes, Introduction to torsion of bars with non-circular sections. Analysis of thick and thin cylinders, compound cylinders. Module 4: (10 hours) Elastic stability of columns, Euler's Buckling load, Unsymmetrical Bending and Shear Centre.. Text Books: 1. R.C. Hibbeler. Mechanics of Materials, Pearson India Education Services Pvt. Ltd 2. F.P. Beer, E.R. Johnston, J.T. DeWolf, D.F. Mazurek. Mechanics of Materials, Tata McGraw-Hill Publishing Company Limited. Reference Books: 1. J.M. Gere and B.J. Goodno. Mechanics of Materials, Cengage Learning. 2. S. Timoshenko. Strength of Materials, Part 1 and Part 2, CBS Publishers & Distributors. 3. U. C. Jindal. Strength of Materials, Pearson India Education Services Pvt. Ltd.		

Subject Code: CE2L102	Name: Hydraulics	L-T-P-C: 3-0-0-3
Prerequisite: None		
Module 1: (12 hours) Properties of fluids, fluid statics, hydrostatics. Kinematics of fluids, continuity and bernoulli equations with applications. Module 2: (16 hours) Conservation of energy equation, conservation of momentum equation, applications in fluid flows. Dimensional analysis, pipe flows and losses, drag and lift forces Module 3: (8 hours) Open channel flows, concept of specific energy and specific force, effect of channel transitions Module 4: (4 hours) Turbomachinery, different types of pumps and turbines, applications of pump characteristic curves. Text Books: 1. Frank M. White, Fluid Mechanics, Fourth Edition, McGraw-Hill, Inc., 1999. 2. R. W. Fox, and A. T. McDonald, Introduction to Fluid Mechanics, Fourth Edition, John Wiley and Sons, Inc., 1992. 3. K Subramanya, Fluid Mechanics and Hydraulic Machines-Problems and Solution, 2nd Edition, McGraw Hill Education, Noida, India, 2018 4. P M Modi and S M Seth, Hydraulics and Fluid Mechanics Including Hydraulics Machines, 22nd Edition, Standard Book house, New Delhi, India, 2022. Reference Books: 1. V L Streeter, E B Wylie, K W Bedford, Fluid Mechanics, 9th Edition, McGraw Hill, New York, 1998 2. Bruce R. Munson, Donald F. Young, and Theodore O. Okiishi, Fundamentals of Fluid Mechanics, Second Edition, John Wiley & Sons, Inc., 1994.		

Subject Code: CE2L103	Name: Geology and Soil Characterization	L-T-P-C: 3-0-0-3
Prerequisite: None		
Module 1: (Geology) (8 hours) Earth's structure and geological time scale - Rock cycle and mineral formation processes - Physical and chemical weathering processes - Geological agents: wind, water, ice, and gravity - Physical properties of minerals. Module 2: (Rock Formation) (8 hours) Rock formation, classification, and properties - Primary and secondary structures in rocks - Groundwater basics. Module 3: (Soil Formation) (12 hours) Soil formation - Weathering - Factors affecting soil formation - Clay mineralogy basics and soil structure types - Physical properties of minerals, silicate structure and its classification, Isomorphism, Texture and structure of minerals - Particle size ranges and soil fabric - Engineering implications of soil structure Module 4: (Index Properties and Soil Classification) (14 hours) Three-phase system - Phase relationships definitions - Concepts of unit weights - Grain size distribution and particle size analysis - Hydrometer analysis - Atterberg limits: liquid limit and plastic limit - Indices - soil classification systems - IS, USCS - Field identification methods. Text Books: 1. Varghese, P.C., "Engineering Geology for Civil Engineers," PHI Learning 2. Murthy, V.N.S., Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering by Marcel Dekkar, Inc., USA. Reference Books: 1. Bell, F.G., "Engineering Geology," 2nd Edition, Butterworth-Heinemann 2. Coduto, D. P. Geotechnical engineering: Principles and practices (2nd ed.). Prentice Hall. 3. Das, B. M., "Principles of Geotechnical Engineering," 8th Edition, Cengage Learning. 4. IS Codes: IS 1498, IS 1888, IS 2720 (Parts 1-8).		

Subject Code: CE2L104	Name: Introduction to Transportation Engineering	L-T-P-C: 3-0-0-3
Prerequisite: None		
Module 1: (9 hours) Introduction to Transportation Planning, Modes of transport, Multi-modal Transportation System, Introduction to highway planning, Classification of roads, Different types of surveys in highway planning, Types of travel surveys, Urban and Rural Roads Planning, Procedure of OD estimation, Socio-Economic impacts. Module 2: (12 hours) Alignment of road, Geometric design of roads, Concept of safe distances, Cross-sectional elements, Driver behaviour, Geometric design of highways, Design of horizontal and vertical curves, Coordination of horizontal and vertical alignment, Highway marking and signs. Module 3: (7 hours) Fundamental traffic flow parameters & their relations Highway capacity and level of service, Traffic control devices, introduction to intelligent transportation system, Traffic Safety studies Module 4: (14 hours) Types of pavements, Introduction of pavement materials and their specifications, analysis of pavements, design of pavements, design factors affecting pavement thickness, Mix design of bituminous mixtures, concept of mixture volumetrics, Introduction to pavement evaluation and maintenance. Text Books: 1. S.K. Khanna, C.E.G. Justo and A. Verraragavan, "Highway Engineering" Nemchand Publishers, Roorkee, India. 2. Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers 3. Chakraborty, P. and Das, A., Principles of Transportation Engineering, 2nd Edition, Prentice Hall of, India 4. Athanassios Nikolaidis, "Highway Engineering", CRC Press, New York. Reference Books: 1. Fred L. Mannering and Scott S. Washburn., Principles of Highway Engineering and Traffic Analysis, 5th Edition, John Wiley and Sons. 2. Relevant Indian Roads Congress Guidelines 3. Roger P. Roess, Elena S. Prassas, William R. McShane, Traffic Engineering, 5th Edition, Pearson 4. P. S. Kandhal, "Bituminous Road Construction in India" PHI Learning, India.		

Subject Code: CE2L105	Name: Geomatics Practices	L-T-P-C: 2-0-2-3
Prerequisite: None		
Module 1: (13 hours) Introduction and basic principles of surveying, element of surveying and mapping, concept of errors and correction. Compass surveying, different types of compass, closed and open traverse, bearings and angles, magnetic dip and declination, Angle and linear misclosure, methods to correct misclosure errors. Module 2: (12 hours) Introduction to plane table surveying, plane table accessories, method of radiation and intersection. Introduction of leveling and contouring, importance of leveling in civil engineering construction, curvature and refraction, level and staff, basic axes in leveling. Different types of leveling, longitudinal and transverse profile of road, Height of collimation and rise-fall method. Collimation error, Correction for collimation, Trigonometric leveling, Contouring, Different methods of contouring. Module 3: (15 hours) Introduction to theodolite, parts of theodolite, Measurement of angles, closed traverse survey, balancing a traverse, latitude and departure, coordinate system. Curves in roads, Different types of curves, methods to set a simple circular curve, Tacheometry, Computation of area and volume, estimation of earthwork based on levels Module 4: (12 hours) Basics of total station, GIS and GPS, Parts of total station, methods of distance measurement. Introduction to remote sensing, Basic of photogrammetry, Stereo-photogrammetry and aerial photogrammetry, Use of drones in photogrammetry. Text Books: 1. C Venkatramaiah, Textbook of Surveying, University Press 2. Punmia, B.C., Jain, A.K. and Jain, A.K. Surveying Vol. I, II and III, Laxmi Publication Pvt. Ltd. 3. Arora, K. R., Surveying Vol. I, II and III, Standard Book House. 4. Gopi, S., Sathikumar, R. and Madu, N., Advanced Surveying: Total Station, GIS and 5. Remote Sensing, Pearson Education India. 6. Subramanian, R.S. Surveying and levelling, Second Edition, Oxford Univ. Press.		

Subject Code: CE2P101	Name: Hydraulics Laboratory	L-T-P-C: 0-0-3-2
Prerequisite: None		
List of Experiments: (30 hours) 1. Flow over notches 2. Hydraulic jump in a Rectangular Channel 3. Estimation of orifice coefficients 4. Verification of Bernoulli's equation 5. Determination of flow properties for free vortex and forced vortex 6. Determination of Darcy's friction factor in pipe flow. 7. Estimation of center of pressure on a submerged body 8. Discharge coefficient of Broad crested weir 9. Determination of the Reynolds number for various regimes of flow through closed conduit using flow visualization technique. 10. Study of Impact of Free Water Jet. Text Books/References: 1. Munson, Okiishi, Huebsch and Rothmayer. Fluid Mechanics, SI Version, Wiley. 2. Hydraulics Laboratory Manual. SIF, IIT Bhubaneswar.		

Subject Code: CE2L106	Name: Structural Analysis-I	L-T-P-C: 3-0-0-3
Prerequisite: None		
Module 1: (16 hours) Fundamentals: Introduction, static determinacy, stability, and kinematic indeterminacy. Force response of statically determinate structures- Trusses, beams, frames; cable and arches. Module 2: (8 hours) Displacement response of statically determinate structures – Double integration method, moment areas method, conjugate beam method for beams. Module 3: (12 hours) Strain energy, principle of work and energy – real and virtual work theorem, unit load method, Maxwell’s reciprocal theorem, Betti’s law, Castigliano’s theorem for beams, curved beams, trusses and frames; uniqueness theorem. Module 4: (6 hours) Influence line diagram and moving load analysis for determinate structures – Müller-Breslau principle. Text Books: 1. Hibbeler, R.C., Structural Analysis, Pearson 2. Kassimali, A., Structural Analysis, Fourth Edition, Cenage Learning 3. G S Pandit and S P Gupta, Theory of Structures- Vol 1, Tata McGraw Hills, Delhi Reference Books: 1. Wang, C.K. Intermediate Structural Analysis, McGraw Hill Education (India) Pvt Ltd. 2. Bhavikatti, S.S. Structural Analysis, Vol-I and II, 4th Edition, Vikas Publishing House Pvt Ltd. 3. Menon, D. Structural Analysis, Narosa Publishing House.		

Subject Code: CE2L107	Name: Water Resources Engineering	L-T-P-C: 3-0-0-3
Prerequisite: None		
Module 1: (11 hours) Introduction to hydrology, hydrologic cycle and concept of watershed. Analysis of hydrologic cycle: precipitation, different types, measurement, data analysis, IDF and DAD curves, interception losses. Module 2: (10 hours) Losses due to infiltration and evapotranspiration, different estimation techniques, measurement methods. Module 3: (12 hours) Surface runoff and streamflow, baseflows, hydrograph analysis, concept of unit hydrograph, measurement of discharge in rivers. Module 4: (8 hours) Dams and reservoirs, irrigation requirement of crops, design of canals, types of cross-drainage works. Text Books: 1. Subramanya, K, Engineering Hydrology, 5th Edition, McGraw Hill Education (India) Private Ltd, Chennai, India, 2021. 2. Raghunath H M, Hydrology: Principles, Analysis, and Design, second edition, New Age International publishers, New Delhi, India, 2006. 3. Garg S K, Hydrology and Water Resources Engineering, 14th Edition, Khanna Publishers, 2007. Reference Books: 1. Chow, V T, Maidment D R, and L W Mays, Applied Hydrology, McGraw Hill-Book Company, New York, 1988. 2. Dingman, S L, Physical hydrology, Third Edition, Waveland Press, Inc., 2014. 3. Garg S K, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1997.		

Subject Code: CE2L108	Name: Soil Mechanics	L-T-P-C: 3-0-0-3
Prerequisite: None		
Module 1: (Flow through Soil) (10 hours) Effective stress: Concepts, total and effective stress, effect of water table, quick condition. Permeability of Soils: Darcy's Law - Methods of Determining Coefficient of Permeability - Seepage: Analysis, Flow Nets, Piping. Module 2: (Compressibility) (10 hours) Compressibility and Consolidation Characteristics - Normally and Overconsolidated Soil - Rate of consolidation - Coefficient of Consolidation. Module 3: (Shear Strength) (12 hours) Shear Strength of Soils: Direct Shear and Triaxial Tests, Mohr-Coulomb Strength Criterion - Consolidated Drained and Undrained Tests, Unconfined Compressive Strength Test - Pore Pressures: Skempton's Pore Pressure Coefficients. Module 4: (Slope Stability) (10 hours) Stability of slopes - Earth pressure: theories, types, calculation, concept of soil arching - Introduction to Critical State Framework. Text Books: 1. Murthy, V.N.S., Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering by Marcel Dekkar, Inc., USA. 2. Das, B. M., "Principles of Geotechnical Engineering," 8th Edition, Cengage Learning Reference Books: 1. Lambe, T.W., Whitman, R.V., Soil Mechanics, John Wiely and Sons, Inc. Canada. 2. Coduto, D. P. Geotechnical engineering: Principles and practices (2nd ed.). Prentice Hall. 3. Terzaghi, K., Ralph B.P. and Mesri, G., Soil Mechanics in Engineering Practice, John Wiely and Sons, Inc. 4. Parry, R.H.G., Mohr Circles, Stress Paths and Geotechnics, E & FN SPON publishers. Muniram, B., Soil Mechanics and Foundations, John Wiely and Sons, Inc.		

Subject Code: CE2L109	Name: Construction Materials	L-T-P-C: 2-0-2-3
Prerequisite: None		
Module 1: (Cement and Concrete) (16 hours) Cement and Cementitious Materials: Manufacture and composition of cement - Testing of cement - Aggregates for Concrete and Pavements Source of aggregates - Testing of aggregates - Alternatives to naturally sourced aggregates Concrete (Fresh and Hardened State): Mix Proportioning - Chemical and Mineral Admixtures in concrete - Tests on fresh and hardened concrete Module 2: (Soil and Pavement Materials) (17 hours) Soil and Geotechnical Materials: Properties and characterization - Testing of soil - Geosynthetics Bituminous and Pavement Materials: Design of Bituminous concrete mixes - Testing of Bitumen and Bituminous concrete Module 2: (Other Building Materials) (10 hours) Steel and Reinforcement Materials: Types and manufacturing of structural steel – Testing - Corrosion of steel, preventive measures Bricks, Masonry Units, and Building Materials: Testing of bricks and tiles - Brick bonds and alternative masonry units (fly ash bricks, blocks) Timber and Miscellaneous Construction Materials: Identification of timber species and defects - Testing of timber - Polymer-based materials and FRP introduction Text Books/References: 1. Duggal, S. K. (2017). Building Materials (5th ed.). New Delhi: McGraw Hill Education (India) Pvt. Ltd. 2. Neville, A.M. and Brooks, J.J. (2010). Concrete Technology, 2nd Edition, Prentice Hall, Pearson Education. 3. Gambhir, M.L. and Jamwal, N. (2014). Building and Construction Materials: Testing and Quality Control, McGraw Hill Education (India) Pvt. Ltd., New Delhi.		

Subject Code: CE2P102	Name: Geotechnical Engineering Laboratory	L-T-P-C: 0-0-3-2
Prerequisite: None		
List of Experiments: (30 hours) 1. Visual and Manual Soil Identification: Description; Quick identification techniques 2. Particle Size Analysis of Soil: Dry sieve analysis, and Hydrometer analysis 3. Specific Gravity and Relative Density: Pycnometer; Table vibrator; Void ratio 4. Permeability: Saturation; Constant head and falling head methods 5. Consistency Limits and Indices: Specific gravity of fine and coarse aggregates 6. Compaction: Proctor compaction, light and heavy compaction 7. Field Density: Sand replacement; Core cutter 8. Consolidation: Oedometer; Settlement - rate of consolidation 9. Shear strength: Direct shear tests, Triaxial shear tests. Text Books/References: 1. Respective Bureau of Indian Standard/ International Standard Codes of Practices (IS 2720). 2. Ranjan, G. and Rao, A. S. R., Basic and Applied Soil Mechanics, New Age International Publishers, New Delhi, India. 3. Bowles, E., Foundation Analysis and Design by Joseph, McGraw Hill Higher, USA. 4. Murthy, V.N.S., Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering by Marcel Dekkar, Inc., USA.		

Subject Code: CE2P103	Name: Transportation Engineering Laboratory	L-T-P-C: 0-0-3-2
Prerequisite: None		
List of Experiments: (30 hours) 1. Specific Gravity and Water Absorption of Aggregates: Specific gravity and water absorption tests 2. Grading of Aggregates, Flakiness and Elongation Index: Dry sieve analysis for grading, Shape test 3. Crushing, Abrasion and Impact Tests on Aggregates: Resistance of the Aggregates against crushing, wear & tear and impact are evaluated 4. Proctor Compaction test on Soil: Moisture-Density Relationship of Soil 5. CBR test on Soil: Determination of CBR value of soil in the laboratory and field (using Dynamic Cone Penetrometer) 6. Tests on Bitumen: Penetration, Ductility, Softening Point and Viscosity - Characterization of Bitumen in terms of penetration value, ductility value, softening point and Viscosity 7. Measurement Road Surface Characteristics: Roughness and Skid Resistance -Road Roughness Measurement using MERLIN and Skid Resistance using Pendulum Skid Tester 8. Tests on Bituminous Mixes: Marshall Stability and Flow Values 9. Classified OD Estimation: Area wide or at Traffic Junction 10. Traffic Studies: Classified Traffic Volume Count and Speed Studies. Text Books/References: 1. Bureau of Indian Standard/ International Standard Codes of Practices. 2. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee. 3. Highway Material Testing and Quality Control by Rao G. Venkatappa, Rao K. Ramachandra, Pahari Kausik, and Rao D.V. Bhavanna.		