B.Tech (Civil Engineering)

SEMESTER –IV

Sl No.	Course Code	Course Title	Hours Per Week			Total Credits	ESE	IA
			Lecture	Tutorial	Practical			
1.	101401	Transportation Engineering	3	0	0	3	70	30
2.	101402	Building Planning and Computer-Aided Civil Engineering Drawing	3	0	0	3	70	30
3.	101403	Geotechnical Engineering-I	3	0	0	3	70	30
4.	101404	Hydraulic Engineering	3	0	0	3	70	30
5.	101405	Structural Analysis	3	0	0	3	70	30
6.	101406	Engineering Geology	3	0	0	3	70	30
7.	101407	Civil Engineering – Societal & Global Impact	3	0	0	0	-	-
8.	101401P	Transportation Engineering Lab	0	0	2	1	30	20
9.	101402P	Building Planning and Computer-Aided Civil Engineering Drawing Lab	0	0	2	1	30	20
10.	101403P	Geotechnical Engineering-I Lab	0	0	2	1	30	20
11.	101404P	Hydraulic Engineering Lab	0	0	2	1	30	20
12.	101406P	Engineering Geology Lab	0	0	2	1	30	20
13.	101408	NPTEL (Open Course)	12 Weeks			3	75	25
					TOTAL	26	900	

Semester-IV

Course Code- 101401 Transportation Engineering 3 0 0 3

Unit- 1.0 **8 hrs**

Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

Unit- 2.0 **5 hrs**

Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems.

Unit- 3.0 **6 hrs**

Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity.

Unit- 4.0 **8 hrs**

Traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems.

Unit- 5.0 **5 hrs**

Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems.

Unit- 6.0 **10 hrs**

Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems.

Text/ Reference:-

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017.
2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
3. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning.
4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley.
5. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

Course Code- 101402 **Building Planning and Computer Aided Civil Engineering Drawings** **3 0 0 3**

Unit- 1.0 **6 hrs**

Principles of Residential and Public Buildings: Concept of built environment and its application in planning. Recommendation of National building code., Green building, Introduction-Benefits, National priorities, rating system, check list, Site selection and planning, Water efficiency, Energy efficiency, Materials, Indoor environmental quality, Innovation and design process.

Unit- 2.0 **9 hrs**

Principle of Planning for differently abled publics: Standardization and Contextualization of accessibility in built environment, Overview of accessibility codes (National and International Perspectives), Design for Inclusion : A holistic Approach (User centric approach to design, WINIT Model), Accessibility Elements of Built Environment in urban and rural Contexts (Kerb Ramps, Bollards, Level and gratings, Ramps, Gradients and other relevant elements) Principle of site planning and approaches for accessibility, Accessibility in public Sanitation System (Washroom typologies and Accessibility perspectives emergency evacuation systems and codes)

Unit- 3.0 **9 hrs**

Planning of Building: Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window. Planning of building such as Residential building –Load bearing structure, RCC framed structure. Building for Education – school, college. Library Building for health – Dispensary, Hospital Industrial structure Building for entertainment-Theatre, club house, sports club. Other structure-Office, Hostel, Guest house.

Building's Water Supply and Drainage & Solid Waste Collection and Disposal System: Design of water supply, waste water and storm water collection system for various types of buildings. Pumps and Pump House. Wet and dry solid waste segregation, Vermi-composting etc. Provision of Chutes. Accessibility in public Sanitation Systems.

Unit- 4.0 **8 hrs**

Electrical Services: Domestic Supply, Distribution Circuits, basic wiring systems. Design and planning: - Lighting of staircase, corridors. Automatic Water Level controller, Closed Circuit Security Monitors with Intercom/ EPBX facility, Common Dish TV antenna, Use of Solar Panels as source of power, Lightening Conductor for High-rise Buildings.

Fire Protection System: Introduction, Fire protection, requirement of water quantity estimation. Systems of firefighting external and internal. Wet and dry risers, smoke alarm, Sprinkler system. Safety corridors in Highrise structures.

Unit- 5.0 **4 hrs**

Elevators: Introduction, types of elevators. Essential features of lifts its size and requirement of minimum numbers, norms for safety doors, Operation and maintenance, Safety norms. Control systems, electrical requirement, and generator back-up, Escalators in Industry and in malls-multiplex. Design of Accessible Circulation System for differently abled publics.

Unit- 6.0 **6 hrs**

Heating Ventilation and Air Conditioning: Ventilation, functional requirement, Heat balance system of ventilation, General rules and regulations in artificial ventilation system, Central air conditioning: - ducting and glass claddings. Operation and maintenance.

Building Management System: Security Guard's Cabin, Postage collection boxes, Parking space.

Text/ Reference:-

1. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).
2. Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805).
3. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117).
4. Croome, J. D. & Roberts, B. M., "AIR-CONDITIONING AND VENTILATION OF BUILDINGS VOL-1". Pergamon Press, (ISBN: 0080247792).
5. SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095).
6. N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990)

Course Code- 101403 Geotechnical Engineering -I 3 0 0 3

Unit- 1.0: 7hrs

Introduction–Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation- moisture content, moisture content-specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method,nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method**.**

On completion of this Unit-, the students must be able to:

- Understand the different types of soil based on their formation mechanism;
- Understand the various phase diagrams and derive various phase relationships of the soil;
  Perform various laboratory experiments to determine moisture content, specific gravity;
  Perform field experiments to estimate the field density of the soil mass

Unit- 2.0 7hrs

Plasticity Characteristics of Soil - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

On completion of this Unit-, the students must be able to:

- Understand the behaviour of soils based on their moisture contents;
- Perform laboratory experiments to estimate various Atterberg limits and evaluate index properties of soils;
- Classify any soils based on their particle size distribution and index properties

Unit- 3.0 7hrs

Permeability of Soil - Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

On completion of this Unit-, the student must be able to:

- Determine the permeability of soils through various laboratory and field tests;
- Analytically calculate the effective permeability of anisotropic soil mass;
- Determine the seepage quantities and pore water pressures below the ground;
- Graphically plot the equipotential lines and flow lines in a seepage flow

Unit- 4.0 7hrs

Effective Stress Principle - Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

On completion of this Unit-, the student must be able to:

- Understand the physical significance of effective stress and its relation with pore pressure;

- Plot various stress distribution diagrams along the depth of the soil mass;
- Understand the effect of capillary action and seepage flow direction on the effective stress at a point in the soil mass.

Unit- 5.0 **7hrs**

Compaction of Soil-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

On completion of this Unit-, the student must be able to:

- Perform laboratory test to determine the maximum dry density and optimum moisture content of the soil;
- Variation in compaction curve with compaction effort and soil type;
- Determine the compactive effort required to obtain necessary degree of compaction in-situ;
- Differentiate among various field methods of compaction and their usage based on the type of soil.

Unit- 6.0 **7hrs**

Stresses in soils – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory. On completion of this Unit-, the student must be able to:

- Analytically compute the vertical stress in a semi-infinite soil mass due to various loading conditions; Plot isobars due various loading conditions.

Text/ Reference:-

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
4. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
5. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
6. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy
7. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
8. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy.

Course Code- 101404 Hydraulic Engineering 2 0 0 2

Unit- 1.0: 5 hrs

Boundary Layer Analysis-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Unit- 2.0: 4 hrs

Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.

Unit- 3.0: 5 hrs

Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n .Most economical section of channel. Computation of Uniform flow, Normal depth.

Unit- 4.0 : 6 hrs

Non-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and Direct integration method.

Unit-5.0: 4 hrs

Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types,applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

Unit- 6.0: 4 hrs

Computational Fluid Dynamics: Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web based modeling in water resources engineering.

Text/ Reference:-

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
5. Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971.

Course Code- 101405 Structural Analysis 3 1 0 4

Unit- 1.0 **8 hrs**

Analysis of indeterminate structures by force methods, flexibility coefficients. unit load method, Influence line and Rolling loads, beam, frames and arches.

Unit- 2.0 **5 hrs**

Energy Methods: Principle of minimum potential energy, principle of virtual work, Castigliano's theorems, Reciprocal theorem.

Unit- 3.0 **6 hrs**

Muller Breslau Principles and its applications to determinate and indeterminate structures.

Unit- 4.0 **8 hrs**

Analysis of Beams and Frames: Moment Area method, Slope deflection method, Three Moment Equation.

Unit- 5.0 **5 hrs**

Moments distribution methods, effect of symmetry and ant symmetry, sway correction.

Unit- 6.0 **10 hrs**

Lateral load analysis: Portal and Cantilever methods, Matrix method of structural analysis, Displacement/Stiffness methods.

Text/ Reference:-

1. C.S. Reddy, Basic Structural Analysis, Second Edition, Tata McGraw Hill, 2005.
2. R.C. Hibbeler, Structural Analysis, Pearson Education, 6th edition, 2009.
3. C.K. Wang, Intermediate Structural Analysis, Tata McGraw Hill, 1984.

Course Code- 101406 Engineering Geology 3 0 0 3

Unit-1.0: **6 hrs**

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects, Brief study of case histories of failure of some Civil Engineering constructions due to geological draw backs. **Mineralogy**-Fundamental of Physical and Optical Mineralogy, minerals alteration, SEM, XRD., methods of identification of identification of common minerals.

Unit-2.0: **8 hrs**

Petrology-Rock cycle and rock forming processes. **Igneous petrology**- Types of magma and their characteristics. Forms, Textures, structures and classification of igneous rocks. **Sedimentary petrology**- Mode of formation, Texture, Structures and Classification of sedimentary rocks and their characteristics. **Metamorphic petrology**- Agents and types of metamorphism, metamorphic grades, Texture, structures and classification of metamorphic rocks. Detailed study of Granite, Rhyolite, Pegmatite, Gabbro, Dolerite, Basalt, Conglomerate, Breccia, Sandstone, Mudstone, Shale, Limestone, Gneiss, Schist and Slate with engineering consideration.

Unit-3.0: **7 hrs**

Geomorphology and Hydrology - Weathering, Erosion and Denudation. Factors affecting weathering and erosion, products of weathering. Geomorphic agents viz river, wind, glacier and ocean and their action. **Ground water**: Hydrological cycle, Factors controlling water bearing capacity of rock. Types of aquifers and its characteristics, Darcy's law. Geological investigation of Ground water.

Unit-4.0: **7 hrs**

Structural Geology- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. **Fold**- classification, Causes and criteria for their recognition in field. **Faults:** classification, major causes and criteria for their recognition in field, **Joints & Unconformity**; Types, Stresses responsible, geotechnical importance. **Core logging,** Rock core Characterization and Rock Quality Designation.

Unit-5.0: **7 hrs**

Geological Hazards - Mass movement- Types and causes, Prevention and mitigation techniques. **Earthquake: Magnitude and intensity of earthquake**. Seismic waves. Revelation from Seismic Records of structure of earth. Seismic Zone in India. **Tsunami**: Causes and occurrence, Volcanic Phenomenon and volcanic products. Types of volcanic eruption. effects of hazards on construction and desirable design solutions, Concept of Hot spring and Geysers.

Unit-6.0: **7 hrs**

Geology of dam, reservoir and tunnel - Required geological consideration for selecting dam, reservoir and tunnel site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to

counteract unsuitable conditions, significance of discontinuities on the dam and tunnel site and treatment giving to such structures. tunneling over break and lining in tunnels. Case studies: related to dams, reservoirs and tunnels.

Text/ Reference:-

1. Engineering Geology by N. Chennakesavulu, McMillan, India Ltd. 2005
2. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
3. Engineering Geology by S K Duggal, H K Pandey Mc Graw Hill Education Pvt Ltd 2014
4. Principles of Engineering Geology by K.V.G.K. Gokhale – B.S publications.
5. F.G. Bell, Fundamental of Engineering B.S. Publications, 2005.
6. Krynine & Judd, Principles of Engineering Geology & Geotechnics, CBS Publishers & Distribution.
7. Engineering Geology by Subinoy Gangopadhyay, Oxford university press.
8. Engineering Geology for Civil Engineers – P.C. Varghese PHI.

Course Code- 101407 Civil Engineering – Societal & Global Impact 3 0 0 0

Unit- 1.0 **3 hrs**

Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis.

Unit- 2.0 **5 hrs**

Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering. Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.

Unit-3.0 **6 hrs**

Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and nonstationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability. Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability.

Unit- 4.0 **5 hrs**

Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development.

Unit- 5.0 **5 hrs**

Population Dynamics covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity; Environmental Management covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment-Case studies (International Airport, thermal power plant).

Unit- 6.0 **4 hrs**

Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept; Biotechnology covering, Basic concepts: Totipotency and

Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications; Biostatistics covering, Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data-Hypothesis testing and ANNOVA (single factor).

Text/ Reference:-

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
6. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130
9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE.Vol. 134, No. 3, May.
10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.
12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30
13. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.
14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.
15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

B.Tech (Civil Engineering) **(SESSION 2024 onwards)**

Course Code- 101401 Transportation Engineering **0 0 2 1**

Perform all Experiments

List of Experiments:

1. To determine the Impact Test Value of an aggregate.
2. To determine the percent wear of aggregate when subjected to abrasion by the Los Angeles Abrasion test
3. To find %wear due to relative rubbing action between the cylindrical stone specimen and the abrading agent as the sand by using the Dorry abrasion test.
4. To determine the specific gravity and water absorbed by the given aggregate
5. To determine the specific gravity of the bitumen sample by balance method.
6. To determine the softening point of bitumen sample using Ring and Ball test.
7. To determine the CBR value of a given soil sample.
8. Determine the Flakiness and elongation index of coarse aggregates.

Course Code- 101402P **Building Planning and Computer Aided Civil Engineering Drawings** **0 0 2 1**

Perform all Experiments

List of Experiments:

1. Preparation of detailed constructional plan of a residential building.
2. Preparation of front elevation, detailed sectional view, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window.
3. Concept of perspective drawing- one point, two-point, three point and uses.
4. Preparation of line plans of various public buildings like:Building for Education – School, College. Library Building for health –Dispensary, Hospital Industrial structure Building for entertainment-Theatre, Club House, Sports Club. Other Structure- Office, Hostel, Guest house.
5. Prepare layout for water supply and drainage for a residential building and for multistoried buildings.
6. Building's Solid Waste Collection and disposal system: Wet and dry solid waste segregation, Vermi-composting etc. Provision of Chutes.
7. Fire Protection System: Design of emergency exits and emergency vehicle routes with fire protection symbols

Course Code- 101403P Geotechnical Engineering –I Lab 0 0 2 1

Perform any 10 Experiments

List of Experiments:

1. Field Density using Core Cutter method.
2. Field Density using Sand replacement method.
3. Natural moisture content using Oven Drying method.
4. Field identification of Fine Grained soils.
5. Specific gravity of Soils.
6. Grain size distribution by Sieve Analysis.
7. Grain size distribution by Hydrometer Analysis.
8. Consistency limits by Liquid limit
9. Consistency limits by Plastic limit
10. Consistency limits by Shrinkage limit.
11. Permeability test using Constant-head test method.
12. Permeability test using Falling-head method.
13. Compaction test: Standard Proctor test.
14. Compaction test: Modified Proctor test.

B.Tech (Civil Engineering) **(SESSION 2024 onwards)**

Course Code- 101404P Hydraulic Engineering Lab 0 0 2 1

Perform any 10 Experiments

List of Experiments:

1. Flow Visualization
2. Studies in Wind Tunnel
3. Boundary Layer
4. Flow around an Aerofoil / circular cylinder
5. Uniform Flow
6. Velocity Distribution in Open channel flow
7. Venturi Flume
8. Standing Wave Flume
9. Gradually Varied Flow
10. Hydraulic Jump
11. Flow under Sluice Gate
12. Flow through pipes
13. Turbulent flow through pipes
14. Flow visualization
15. Laminar flow through pipes
16. Major losses / Minor losses in pipe.

Course Code- 101406P Engineering Geology Lab **0 0 2 1**

Perform all Experiments

List of Experiments:

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: **Silica group**: Quartz, Amethyst, Opal; **Feldspar group**: Orthoclase, Plagioclase; **Cryptocrystalline group**: Jasper; **Carbonate group**: Calcite; **Pyroxene group**: Augite, Diopside, **Mica group**: Biotite, Muscovite; **Amphibole group**: Hornblende, other silicates- Olivine, Asbestos, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. **Identification of rocks (Igneous Petrology)**: Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. **Identification of rocks (Sedimentary Petrology)**: Conglomerate, Breccia, Sandstone and its varieties, Laterite, Limestone and its varieties, Shales and its varieties.
7. **Identification of rocks (Metamorphic Petrology)**: Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps. **Identification of symbols in maps.**

B.Tech (Civil Engineering) **(SESSION 2024 onwards)**

Course Code- 101408 **NPTEL-I (Open Course)** **12 Weeks (3 Credits)**

NPTEL (Open Course) Guidelines:

NPTEL (Open Course) should be taken from the course other than core subjects of the branch