Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Civil Engineering

(Applicable from the academic session 2018-2019)

Semester IV [Second year]

CE(ES)401	Introduction to Fluid Mechanics	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. define basic terms, values and laws in the areas of fluids properties, statics, kinematics and dynamics of fluids, and hydraulic design of pipe systems; 2. describe methods of implementing fluid mechanics laws and phenomena while analyzing the operational parameters of hydraulic problems; 3. practically apply tables and diagrams, and equations that define the associated laws; 4. calculate and optimize operational parameters of hydraulic problems; 5. explain the correlation between different operational parameters; 6. select engineering approach to problem solving based on the acquired physics and mathematical knowledge.		
Prerequisite	Introduction to Civil Engineering, Physics.		
Module 1	**Properties of fluids:** Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension.		3L
Module 2	**Fluid statics:** Pressure at a point, basic equation for pressure field, pressure variation in a fluid at rest- incompressible fluid, compressible fluid, absolute pressure, gauge pressure; pressure measurements by manometers – general, inclined, inverted, micro-manometer; pressure and forces on submerged planes and curved surfaces, centre of pressure, buoyancy and floatation, Stability of submerged and floating bodies, metacentric height.		4L
Module 3:	**Fluid Kinematics:** The velocity field, Eulerian and Lagrangian flow descriptions, concepts of: - one-, two- and three-dimensional flows, steady and unsteady flows, streamlines, streaklines, pathlines; The acceleration field; Control volume and system representation, Continuity Equation, Momentum Equation, Moment-of-momentum equation, applications to pipe bends.		6L
Module 4:	**Fluid Dynamics:** Application of Newton's Law along a streamline, Bernoulli Equation, Kinetic energy head, potential energy head and pressure energy head, total energy head, Pitot tube, Examples of use of Bernoulli Equation, measurement of flows - venturimeter, energy line and hydraulic grade line.		7L
Module 5:	**Dimensional Analysis:** Buckingham Pi Theorem, determination of Pi terms, correlation of experimental data, examples.		3L
Module 6	**Flow through Pipes:** Laminar flow, Reynolds number, critical velocity, turbulent flow, shear stress at pipe wall, velocity distribution, loss of head for laminar flow, Darcy-Weisbach Formula, friction factor, contraction and expansion head losses. Concept of boundary layer and its growth.		7L
Module 7	**Pipeline Systems:** Pipes in series, pipes in parallel, equivalent pipes, branching pipes, pipe networks.		7L
Module 8	**Hydraulic Machines:** Basics of hydraulic machines, specific speed of pumps and turbines.		3L

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Fluid Mechanics	Sadhu Singh	Khanna Publishing House
	2	A Textbook of Fluid Mechanics	R. K. Bansal	Laxmi Publications (P) Ltd., New Delhi.
	3	Hydraulics & Fluid Mechanics Including Hydraulics Machines	P. N. Modi and S. M. Seth	Standard Book House, New Delhi, 2017.
	4	Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas and S. Chakraborty	Tata McGraw Hill Education Private Limited, New Delhi, 2012.
	5	Fluid Mechanics	F. M. White	Tata McGraw Hill Education India Private Limited, 2017.
	6	Fluid Mechanics and Hydraulic Machines	K. Subramanya	McGraw Hill Education (India)

CE(ES)402	Introduction to Solid Mechanics	2L + 0T	2 Credits
Course Outcome	After going through this course, the students will be able to: **1.** To identify the equilibrium conditions and elastic properties of axially loaded bars through stress-strain and force-displacement curves. **2.** To identify the principal plane and principal stresses through Mohr circle. **3.** To calculate the hoop and meridional stresses in thin cylinders and spherical shells. **4.** To identify different degrees of freedoms for support conditions like hinge, roller and fixed		

	constraints. **5.** To calculate the bending moment, shear force and deflection of beams for uniformly distributed, concentrated, linearly varying and external concentrated moment. **6.** To calculate the member forces in a plane truss using Method of Joint and Method of Section. **7.** To identify torsional moment and twist on a circular shaft and calculate the shear stress. **8.** To know the concepts of strain energy due to axial load, bending and shear. **9.** To calculate the buckling load of columns using Euler's theory for different support constraints	
Prerequisite	Engineering Mechanics (CE(ES)301), Basic Calculus	
Module 1	**Review of Basic Concepts of Stress and Strain:** Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety, Beam Statics: Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever and overhanging beams	6L
Module 2	**Symmetric Beam Bending**: Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear centre	3L
Module 3:	**Deflection of statically determinate beams**: Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration solution	4L
Module 4:	**Analysis of determinate plane trusses**: Concepts of redundancy, Analysis by method of joints, method of sections	4L
Module 5:	**Two Dimensional Stress Problems**: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle	3L
Module 6	**Introduction to thin cylindrical & spherical shells**: Hoop stress and meridional - stress and volumetric changes	3L
Module 7	**Torsion**: Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs	4L
Module 8	**Columns:** Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load and secant formulae.	3L

Reference

Sl.	Book Name	Author	Publishing House
1	Strength of Materials	D.S. Bedi	Khanna Publishing House
2	Elements of Strength of Material	S. P. Timoshenko and D. H. Young	EWP Pvt. Ltd
3	Mechanics of Material	R.C. Hibbeler	Pearson
4	Mechanics of Material	Beer, Jhonston, DeWolf, Mazurek	McGrawHill Education
5	Strength of Materials	R. Subramanian	OXFORD University Press
6	Strength of Materials	S S Bhavikatti	Vikas Publishing House Ltd
7	Strength of Materials	R.K. Bansal	Laxmi Publication
8	Fundamentals of Strength of Material	Nag & Chandra	WIE

CE(PC)401	**Soil Mechanics – I**	2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: **1.** Classify soil as per grain size distribution curve and understand the index properties of soil. **2.** Apply the concept of total stress, effective stress and pore water pressure for solving geotechnical problems. **3.** Assess the permeability of different types of soil and solve flow problems. **4.** Estimate the seepage loss, factor of safety against piping failure using flow net related to any hydraulic structure. **5.** Determine vertical stress on a horizontal plane within a soil mass subjected to different types of loading on the ground surface and also the maximum stressed zone or isobar below a loaded area. **6.** Apply the concept of shear strength to analyze different geotechnical problems and determine the shear strength parameters from lab and field tests.		
Prerequisite	Engineering Mechanics		
Module 1	**PHYSICAL PROPERTIES OF SOILS:** **Soil Formation** Introduction, Origin of Soil, Formation and Types of soil, Formative classification, Typical Indian Soil, Some Special Types of Soils, Structure and Composition, Clay Mineralogy. **Soil as a Three Phase System** Basic Definitions, Weight - Volume Relationship, Measurement of Physical		10L + 5T

	Properties of Soil: Insitu Density, Moisture Content, Specific Gravity, Relative density, Functional Relationships. **Index Properties of Soil** Introduction, Particle Size Distribution, Mechanical Analysis - Sieve Analysis, Sedimentation Analysis – Hydrometer and Pipette Methods. Consistency of Soil – Atterberg Limits, Different Indices, Discussion on Limits and Indices. **Classification of Soil** Classification by Structure, Particle Size Classification, Textural System, PRA System (AASHTO Classification), Unified Classification System, As per IS Code Recommendation, Field Identification of Soil, Classification by Casagrande's Plasticity Chart.	
Module 2	**Soil Hydraulics** Modes of Occurrence of Water in Soil – Free Water, Held Water, Structural Water, Capillary Water, Gravitational Water, Adsorbed Water, Pore Water, Pore Water Pressure, Effective Pressure, Total Pressure, Effective Pressure under Different Conditions and in Different Cases of Flow through Soils, Critical Hydraulic Gradient, Quick Sand Condition.	3L + 1T
Module 3:	**Permeability** Introduction, Darcy's Law, Coefficient of Permeability, Discharge Velocity, Seepage Velocity, Factors Affecting Permeability. Determination of Coefficient of Permeability – Constant Head and Falling Head Methods, Permeability of Stratified Soil Deposits, Field Determination of Permeability – Unconfined and Confined Aquifers.	3L + 1T
Module 4:	**Seepage Analysis** Introduction, Seepage, Seepage Pressure, Two Dimensional Flow, Laplace's Equations, Continuity equation, Flow Nets, Flow through Earthen Dam, Estimation of Seepage, Construction, Properties and Use of Flow Nets, Piping and Heaving, Uplift due to Seepage, Design of Fillers.	3L + 1T
Module 5:	**STRESS DISTRIBUTION IN SOILS** Introduction, Geostatic Stress, Boussinesq's Equation, Determination of Stress due to Point Load, Vertical Stress Distribution on a Horizontal Plane, Isobar and Pressure Bulb, Vertical Stress Distribution on a Vertical Plane, Vertical Stress under Uniformly Loaded Circular Area, Vertical Stress Beneath a Corner of a Rectangular Area, Equivalent Point Load Method, 2:1 Method, Newmark's Influence Chart, Vertical Stress Beneath Line and Strip Loads. Westergaard Analysis, Comparison of Boussinesq and Westergaard Theories, Contact Pressure.	4L + 2T
Module 6	**SHEARING STRENGTH OF SOILS** Shear Strength of Soil Introduction, Basic Concept of Shear Resistance and Shear Strength of Soil, Mohr Circle of Stress, Sign Conventions, Mohr - Coulomb Theory, Relationship between Principal Stresses and Cohesion. Determination of Shear Parameters of Soil Stress Controlled and Strain Controlled Tests, Laboratory Determination of Soil Shear Parameters- Direct Shear Test, Triaxial Test, Classification of Shear Tests Based on Drainage Conditions, Unconfined Compression Test, Vane Shear Test as per Relevant IS Codes. Stress- Strain Relationship of Clays and Sands, Concept of Critical Void Ratio. Skempton's Pore Pressure Parameters. Sensitivity and Thixotropy of clay. Concept of Stress path.	5L + 3T

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers
	2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd
	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt.Ltd, Publishers
	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole

CE(PC)402	**Environmental Engineering – I**	2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: 1. Define the basic concepts and terminologies of water supply engineering and solid waste management 2. Describe different surface and groundwater sources; and composition and characteristics of municipal solid waste 3. Apply the methods of quantifying water requirement and MSW generation 4. Solve different mathematical problems regarding different components of water supply systems, distribution networks and MSW management systems		

	5. Compare between different water samples based on their physical, chemical and biological characteristics 6. Design different unit processes and operations involved in water treatment and MSW management	
Prerequisite	Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Engineering Mechanics, Fluid Mechanics and Hydraulics	
Module 1	**Water Requirement Estimation** Water Demand: Different types of water demand; Per capita demand; Variations in demand; Factors affecting water demand Future Demand Forecasting: Design period; Population forecasting methods	2L + 2T
Module 2	**Sources of Water** Surface Water Sources; Ground Water Sources	4L + 2T
Module 3:	**Water Quality** Water Quality Characteristics: Physical, Chemical, and Biological parameters Drinking Water Standards: BIS; WHO; USEPA Water Quality Indices: Basic concept and examples	4L + 2T
Module 4:	**Water Treatment** Typical flow chart for surface and groundwater treatments Unit Operation and Processes: Aeration, Plain Sedimentation, Sedimentation with Coagulation and Flocculation, Water Softening, Filtration, Disinfection	9L + 3T
Module 5:	**Water Conveyance and Distribution** Hydraulic design of pressure pipes; Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs.	4L + 2T
Module 6	**Characteristics of Municipal Solid Waste (MSW)** Composition and characteristics of MSW	1L + 1T
Module 7	**Handling of MSW** Generation, collection and transportation of MSW	1L + 1T
Module 8	**Engineered Systems for MSW Management** Methods of reuse/ recycle, energy recovery, treatment and disposal of MSW	3L + 1T

Reference

Sl.	Book Name	Author	Publishing House
1	Environmental Engineering	S.C. Sharma	Khanna Publishing House
2	Environmental Engineering. Volume-1 and Volume-2	Garg, S.K.	Khanna Publishers
3	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
4	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson
5	Elements of Environmental Pollution Control	O.P. Gupta	Khanna Publishing House
6`	Elements of Solid & Hazardous Waste Management	O.P. Gupta	Khanna Publishing House
7	Manual on Water Supply and Treatment	CPHEEO	Govt. of India
8	Manual on Municipal Solid Waste Management.	CPHEEO	Govt. of India

CE(PC)403	**Surveying & Geomatics**	2L + 1T	3 Credits
Course Outcome	Upon completing the course, the students will be able to: **1.** Define and state the scope of surveying and geomatics in civil engineering **2.** Understand the basic principles of surveying and geomatics engineering **3.** Apply the different methods of surveying and geomatics to measure the features of interest **4.** Analyze the traditional and advanced methods of surveying **5.** Evaluate the different techniques of surveying and geomatics in solving real world problems. **6.** Design and construct solutions for real world problems related to surveying and geomatics.		
Prerequisite	Knowledge of Mathematics and Physics in Class-XII		
Module 1	**Principles of Surveying:**		4L + 2T

	Introduction, Principles and classification of surveying; Concept of scales; Survey stations and lines – ranging and bearing; Chain surveying – Concept, Instruments, numerical problems on errors due to incorrect chain; Plane table surveying – Advantages, disadvantages, parts, methods; Elements of simple and compound curves.	
Module 2	**Levelling:** Levelling – Principles, Precautions and Difficulties; Differential levelling, -- Concepts and numerical problems; Contouring.	3L + 1T
Module 3:	**Triangulation and Trilateration**: Theodolite survey – Instruments, measurements of horizontal and vertical angles; Triangulation – Network, signals, numerical examples; Baseline measurement – site selection, measuring equipments, numerical problems on baseline corrections; Trigonometric levelling – Axis signal correction.	4L + 2T
Module 4:	**Advanced Surveying**: Principle of Electronic Distance Measurement (EDM); Types of EDM instruments; Distomats; Total Station – Parts, advantages, applications, field procedure and errors; Global Positioning System (GPS) – Concept, applications, segments, location determination, errors; Principle of Differential GPS; Terrestrial laser scanner.	3L + 2T
Module 5:	**Photogrammetric Surveying**: Concept; Classification of photogrammetric surveying – terrestrial, aerial and satellite; scale of a vertical photograph; relief displacement and object height determination; Stereoscopic vision – depth perception, parallactic angle, stereoscopes; Object height determination using parallax; Parallax bar; Flight planning – Concept and numerical problems; Photo mosaic; Orthophotography; Stereoscopic plotting instruments.	4L + 2T
Module 6	**Remote Sensing**: Energy sources and radiation principles; Concept of Electromagnetic Spectrum; Energy interactions in the atmosphere and earth surface features; Data acquisition and interpretation; Platforms and sensors – Geostationary and sun-synchronous orbits, pushbroom and whiskbroom scanning system, characteristics of IRS, Landsat and Sentinel sensors; Visual image interpretation	3L + 2T
Module 7	**Digital Image Processing**: Concept; Image rectification and restoration; Image enhancement; Image classification; Accuracy assessment and post classification smoothing.	4L + 2T
Module 8	**Applications of Geomatics in Civil Engineering**: 3D mapping; Earthquake and landslides; Runoff modelling; Groundwater targeting; Flood risk assessment; Urban planning; Highway and transportation	3L + 1T

Reference

Sl.	Book Name	Author	Publishing House
1	Surveying & Levelling	N. N. Basak	McGraw Hill Education (India) Private Limited
2	Surveying – Vol. I, II & III	B. C. Punmia Ashok Kumar Jain Arun Kumar Jain	Laxmi Publications (P) Ltd.
3	Surveying – Vol. I & II	S. K. Duggal	McGraw Hill Education (India) Private Limited
4	Surveying & Levelling – Part I & II	T. P. Kanetkar S. V. Kulkarni	Pune Vidyarthi Griha Prakashan
5	Remote Sensing and Image Interpretation	Thomas M. Lillesand Ralph W. Kiefer Jonathan W. Chipman	Wiley India Edition
6	Remote Sensing and GIS	Basudeb Bhatta	Oxford University Press
7	Principles of Geoinformatics	P.K. Garg	Khanna Publishing House
8	Applications of Geomatics in Civil Engineering	J. K. Ghosh I. de Silva (Eds.)	Springer

CE(PC)404	**Concrete Technology**	2L + 1T	3 Credits
Course Outcome	On completion of the course, the students will be able to: **1.** test all the required properties of concrete materials as per IS code. **2.** compute the properties of concrete at fresh and hardened state. **3.** design the concrete mix as per latest IS code methods. **4.** ensure quality control while testing/ sampling. **5.** Design the special type of concrete for specific application purposes. **6.** Use the admixture as per requirement.		
Prerequisite	Introduction to Civil Engineering CE(HS)302, Chemistry BS-CH101.		

Module 1	**Cement:** Manufacturing of cement, Oxides composition of cement and the calculation of compounds, Heat of hydration, Types of cement-OPC, RPC. Low heat cement, PPC, PSC, Sulphate resisting cement, High Alumina cement, Expansive cement, White cement; Test on cement- fineness, consistency, initial setting time & final setting time, soundness test, strength test, specific gravity of cement, storage of cement.	5L + 3T
Module 2	**Aggregates**: Classification, Grading, alkali-aggregate reaction, deleterious substances in aggregates, physical properties, testing of aggregates- fineness modulus, bulking, specific gravity, sieve analysis, flakiness & elongation index. Quality of Water for mixing and curing - use of sea water for mixing concrete.	3L + 1T
Module 3:	**Properties of fresh concrete**: Workability, factors affecting workability, segregation and bleeding, tests on workability- slump test, compacting factor test, vee-bee test, flow table test.	3L + 1T
Module 4:	**Properties of Hardened concrete**: Tensile & compressive strength, flexural strength, stress-strain characteristics, modulus of elasticity, poisson's ratio, Creep, shrinkage, permeability of concrete, micro cracking of concrete.	3L + 1T
Module 5:	**Strength of concrete**: curing methods, water-cement ratio. gel-space ratio, maturity of concrete,	3L + 1T
Module 6	**Admixtures**: types, uses, superplasticizers, plasticizers, Bonding admixtures.	2L + 1T
Module 7	**Mix Design** – Objective, factors influencing mix proportion - Mix design by I.S. 10262-2019. (with & without admixture)	3L + 1T
Module 8	**Non-destructive test**: Rebound hammer and Ultra-sonic pulse velocity testing methods. Quality control - Sampling and testing, Acceptance criteria.	3L + 1T
Module 9	**Special Concrete** – Ferrocement - Fibre reinforced concrete - Polymer concrete - Sulphur Concrete - Self compacting concrete. Ready mix concrete, Batching plant.	4L + 1T

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Concrete Technology (Theory & Practice)	Shetty, M.S.	S. Chand and Co.
	2	Concrete Technology	Gambhir, M.L.	Tata McGraw Hill
	3	Concrete Technology	A. M. Nevillie and J.J. Brooks	Pearson Education India Ltd.
	4	Properties of Concrete	A.M.Neville	Pearson India

CE(HS)401	**Civil Engineering – Societal and Global Impact**	2L + 0T	2 Credits
Course Outcome	On completion of the course, the students will be able to: **1.** The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively. **2.** The extent of Infrastructure, its requirements for energy and how they are met: past, present and future **3.** The Sustainability of the Environment, including its Aesthetics, **4.** The potentials of Civil Engineering for Employment creation and its Contribution to the GDP **5.** The Built Environment and factors impacting the Quality of Life **6.** The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial. **7.** Applying professional and responsible judgement and take a leadership role;		
Prerequisite			
Module 1	**Introduction** to Course and Overview; Understanding the past to look into the future: Preindustrial 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;		3L
Module 2	**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		3L
Module 3:	**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;		8L

	Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;	
Module 4:	**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 non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.	7L
Module 5:	**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	5L
Module 6	**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	4L

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	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.	Žiga Turk (2014)	Springer
	2	Elements of Environmental Pollution Control	O.P. Gupta	Khanna Publishing House
	3	Engineering impacting Social, Economical and Working Environment	Brito, Ciampi, Vasconcelos, Amarol, Barros (2013)	120th ASEE Annual Conference and Exposition

CE(MC)401	**Management – I (Organizational Behaviour)**	2L + 0T	2 Credits
Module 1	Introduction to Organizational Behaviour-Concept, Importance, Challenges and Opportunities Personality-Meaning of Personality, Personality Determinants and Traits, Psychoanalytic Theory, Argyris Immaturity to Maturity Continuum Impact on organization. Attitude-Concept, Components, Cognitive Dissonance Theory, Attitude Surveys.		5L
Module 2	Perception- Concept, Nature and Importance, Process of Perception, Factors influencing perception, Perceptual Selectivity, Shortcuts to Judge Others: Halo Effect, Stereotyping, Projection and Contrast Effects, Impact on Organization. Motivation-Definition, Theories of Motivation-Maslow's Hierarchy of Needs Theory, McGregor's Theory X&Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.		6L
Module 3:	Leadership-Concept, Leadership Styles, Theories-Behavioural Theory: Ohio Studies, Michigan Studies, Blake & Mouton Managerial Grid; Contingency Theory: Fielder Theory. Group Behaviour: Definition, Characteristics of Group, Types of Groups: Formal & Informal; Stages of Group Development, Group Decision making, Group Decision Making Vs Individual Decision Making.		8L
Module 4:	Organizational Design-Various organizational structures and their pros and cons. Concepts of organizational climate and culture, Organizational Politics-Concept, Factors influencing degree of Politics Conflict management- Concept, Sources of conflict, Stages of conflict process, Conflict resolution techniques, Tools-Johari Window to analyse and reduce		5L

	interpersonal conflict, Impact on organization.		
Reference	**Sl.**	**Book Name**	**Author**
	1	Organization Behaviour	Stephen Robbins
	2	Organization Behaviour	Luthans
	3	Organization Behaviour	L.M. Prasad
	4	Organization Behaviour : Text, Cases &Games	K. Aswathappa

CE(ES)491	**Fluid Mechanics Laboratory**	2P	1 Credits
Course Outcome	On completion of the course, the students will be able to: **1.** Calibrate the notch and orifice meter. **2.** Evaluate the performance of pump and turbine. **3.** Determine the various hydraulic coefficients. **4.** Determine the minor losses through pipes. **5.** Measure the water surface profile due to formation of hydraulic jump. **6.** Measure the water surface profile for flow over Broad crested weir.		
Prerequisite	Introduction to Fluid Mechanics CE(ES)401		
Experiment 1	Calibration of Notches		
Experiment 2	Calibration of Orifice meter		
Experiment 3	Determination of Hydraulic Coefficient of an Orifice		
Experiment 4	Performance Test on Centrifugal Pump		
Experiment 5	Performance Test on Reciprocating Pump		
Experiment 6	Determination of Minor Losses in Pipes due to Sudden Enlargement and Sudden Contraction		
Experiment 7	Performance Test on Pelton Wheel Turbine		
Experiment 8	Measurement of water surface profile for flow over Broad crested weir		
Experiment 9	Measurement of water surface profile for a hydraulic jump		

CE(ES)492	**Solid Mechanics Laboratory**	2P	1 Credits
Course Outcome	After going through this course, the students will be able to: **1.** Demonstrate the method and findings of tension and compression tests on ductile and brittle materials. **2.** Explain the method of bending tests on mild steel beam and concrete beam. **3.** Demonstrate the method and findings of Torsion test on mild steel circular bar and concrete beam. **4.** Illustrate the concept of hardness and explain the procedure and findings of Brinnel and Rockwell tests. **5.** Demonstrate the concept and procedure of calculation of spring constant and elaborate its use in Civil Engineering. **6.** Demonstrate the method and findings of Izod and Charpy impact tests. **7.** Understand the concepts of fatigue test.		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402)		
Experiment 1	Tension test on Structural Materials: Mild Steel and Tor steel (HYSD bars)		
Experiment 2	Compression Test on Structural Materials: Timber, bricks and concrete cubes		
Experiment 3	Bending Test on Mild Steel		
Experiment 4	Torsion Test on Mild Steel Circular Bar		
Experiment 5	Hardness Tests on Ferrous and Non-Ferrous Metals: Brinnel and Rockwell Tests		
Experiment 6	Test on closely coiled helical spring		
Experiment 7	Impact Test: Izod and Charpy		
Experiment 8	Demonstration of Fatigue Test		

CE(ES)493	**Engineering Geology Laboratory**	2P	1 Credits
Course Outcome	Upon completion of the course, the students will be able to: **1.** Define and state the role of engineering geology in civil engineering		

	2. Understand origin of rocks and geologic structures **3.** Apply different tools to identify rocks and minerals in hand specimen and under microscope **4.** Analyze the geological structures through drawing the cross sections from the geological maps **5.** Evaluate the results obtained from different geological experiments **6.** Investigate the natural hazards/disasters that are caused by the geological reasons
Prerequisite	Knowledge of basic physics and chemistry
Experiment 1	Identification of minerals in hand specimen
Experiment 2	Identification of igneous rocks in hand specimen
Experiment 3	Identification of sedimentary rocks in hand specimen
Experiment 4	Identification of metamorphic rocks in hand specimen
Experiment 5	Study of crystals with the help of crystal models
Experiment 6	Study of geologic structures with the help of models
Experiment 7	Interpretation of geological maps: horizontal, vertical, uniclinal, folded and faulted structures
Experiment 8	Microscopic study of rocks and minerals

CE(PC)493	**Surveying & Geomatics Laboratory**	2P	1 Credits
Course Outcome	Upon completion of the course, the students will be able to: **1.** State the interdependency and advancement of different surveying methods **2.** Comprehend the working principles of different surveying and geomatics instruments and experiments **3.** Execute the different methods of surveying and geomatics to measure the features of interest **4.** Examine the results obtained from the surveying and geomatics experiments **5.** Critically appraise the different techniques of surveying and geomatics in measuring and assessing the features of interest **6.** Design and construct solutions for real world problems related to surveying and geomatics.		
Prerequisite	Surveying & Geomatics [CE(PC)403]		
Experiment 1	Traverse survey by Prismatic Compass: Procedure; Computation and checks on closed traverse; Preparation of field book; Plotting the traverse; Sources of errors.		
Experiment 2	Theodolite Survey: Closed traverse by transit theodolite, Preparation of field book		
Experiment 3	Differential Levelling using Dumpy level: Collimation and Rise and Fall methods, Field book preparation		
Experiment 4	Total Station Survey: Traversing and Levelling		
Experiment 5	Visual Image Interpretation		
Experiment 6	Satellite Image Pre-processing		
Experiment 7	Digital Image Classification and Accuracy Assessment		
Experiment 8	Stereoscopic fusion of aerial photographs using mirror stereoscope		

CE(PC)494	**Concrete Technology Laboratory**	2P	1 Credits
Course Outcome	On completion of the course, the students will be able to: **1.** Demonstrate the method and findings of tension and compression tests on concrete. **2.** Understand the concepts of different test on hardened concrete. **3.** Calculate the specific gravity of concrete ingredients. **4.** Find out the mix proportion of high grade of concrete. **5.** Measure the workability of concrete mix. **6.** Know about the quality of concrete. **7.** Understand the different properties of cement.		
Prerequisite	Concrete Technology CE(PC)404		
Test on Fine aggregates	Bulking, Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.		
Test on Coarse aggregates	Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.		
Test on Cement	Normal consistency, fineness, Initial setting and final setting time of cement. Specific gravity, soundness and Compressive strength of Cement.		

Test on Fresh Concrete	Concrete mix design, Various workability tests – slump, compacting factor, vee-bee test.
Test on Hardened Concrete	Spilt-tensile strength test, Flexure test, NDT Tests (Rebound hammer and Ultra-sonic pulse velocity), Poission ratio.