School of Engineering & Technology

DEPARTMENT OF CIVIL ENGINEERING

B.Tech - Civil Engineering

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Semester IV

Sl.No	Course Code	Course Name	Hours per week			Credits
			L	T	P	
1.	BCE23401T	Transportation Engineering	2	0	0	2
2.	BCE23411P	Transportation Engineering	0	0	2	1
3.	BCE23402T	Surveying and Geomatics	3	0	0	3
4.	BCE23412P	Surveying and Geomatics	0	0	2	1
5.	BCE23403T	Geotechnical Engineering	3	0	0	3
6.	BCE23413P	Geotechnical Engineering	0	0	2	1
7.	BCE23404T	Hydraulic Engineering	3	0	0	3
8.	BCE23414P	Hydraulic Engineering	0	0	2	1
9.	BCE23405T	Structural Analysis	3	1	0	4
10.	BCE23406T	Construction Engineering & Management	3	0	0	3
11.	MNC-AC	Civil Engineering-Societal & Global Impact	3	0	0	0
		Total	**20**	**1**	**8**	**22**
12.		Minor/Honours/Value Added Courses (Optional)	3	0	0	3

Multidisciplinary Open Electives Courses

MOPEC – 01,02,03,04 – 4 courses x 3 credit each starts from Semester V

Multidisciplinary and holistic education across the sciences, social sciences, arts, humanities, and sports for a multidisciplinary world

https://www.ugc.gov.in/pdfnews/7193743_FYUGP.pdf

Table 1, pg:15

EXIT OPTIONS FOR CIVIL ENGINEERING

ANNEXURE – B

(ref:pg.179/pg:212,AICTE Model Curriculum for Undergraduate degree in Civil)

Semester	Exit Option	Credits	Additional Credits for Exit students	List of exit courses
Sem I & II	U.G Certificate	40	6-8	• Materials and Civil Engineering (3-0-0=3Credits) • Testing of Civil Engineering Materials (0-0-4=2 Credits) • Introduction to construction methodology and techniques (3-0-0= 3 Credits) • Introduction to construction equipment (3-0-0=3 Credits) • Site Supervision work (0-0-4=2Credits) • Survey Work (0-0-4=2Credits) • Bar-Bending schedule work (0-0-4=2Credits) • Introduction to Geodetic Surveying and Remote sensing (2-0-4=3 Credits) • Application of Autonomous Vehicle and Safety Regulations (2-0-2 = 3credits)
Sem III & IV	U.G Diploma	44	6-8	• Advance Concrete Technology (2-0-4=3Credits) • Fundamentals of structural Design (2-0-0=2Credits) • Quantity Survey and Estimation (2-0-4=3Credits) • Transportation Engineering (2-0-4=3Credits) • Geotechnical Engineering (2-0-4=3Credits) • Sustainable Construction and Lean Construction (3- 0-0 = 3 credits) • Prefabricated structures (3-0-0=3Credits) • Environmental Impact Assessment (3-0-0=3 Credits) • Digital Construction lab (0-0-6=3Credits) • Introduction to Building Information Modelling (BIM) (2-0-4 = 4 Credits)

BCE23401T	TRANSPORTATION ENGINEERING	L	T	P	C
		2	0	0	2

Pre-requisite: Nil

Course Objectives:

1. Equip students with the ability to understand and apply transportation planning principles and methodologies.
2. Develop students' skills in the geometric design of highways, ensuring safety and efficiency.
3. Provide knowledge and skills to manage and optimize traffic flow and safety.
4. Foster an understanding of sustainability concepts and their application in transportation

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Carry out surveys involved in planning and highway alignment
2. Design Highway geometric
3. Carry out traffic studies and implement traffic regulation and control measures and intersection design
4. Characterize the pavement materials and design a bituminous mix.
5. Design flexible and rigid pavements as per IRC

Module:1 *Highway development and planning*	**1 hours**
Classification of roads, road development in India, Current Road projects in India; highway alignment and project preparation.	
Module:2 *Geometric design of highways*	**6 hours**
Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems.	
Module:3 *Accessibility to Differently Abled Publics*	**3 hours**
Design of Access Routes &Walkways (Elements of walkways, Tactile Navigation Systems, BRT Systems, Pedestrian streets and other related aspects), Accessible Streets and Mobility Environments (Street Elements for Accessibility, dimensions and codes material, TGSIs), Inclusive Public Transportation System	
Module:4 *Traffic engineering & control*	**4 hours**
Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems	
Module:5 *Pavement materials*	**5 hours**
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	
Module:6 *Design of pavements*	**5 hours**
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.	
Total Lecture hours	**24 hours**

Text Book(s)

1.	Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
	Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning,
1.	Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
2.	Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
3.	Kadiyalai, L.R., 'Transportation Engineering', Khanna Book Publishing Co., New Delhi.

BCE23402T	SURVEYING AND GEOMATICS	L	T	P	C
		3	0	0	3

Pre-requisite: Nil

Course Objectives:

- To describe the function of surveying, survey observation and perform calculations for civil engineering projects.
- To identify and calculate the sources of measurement errors and mistakes, difference between accuracy and precision, levelling and angular measurements, open and closed traverse.
- To communicate with team members during field activities; identify appropriate safety procedures for personal protection; properly handle and use measurement instruments.

Expected Course Outcome:

- Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
- Translate the knowledge gained for the implementation of Civil infrastructure facilities.
- Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

Module 1: *Introduction to Surveying*	***6 hours***
Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes.	
Module 2: *Triangulation and Trilateration*	***6 Hours***
Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines - corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric levelling - Axis single corrections.	
Module 3: *Curves*	***6 hours***
Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves	
Module 4: *Modern Field Survey Systems*	***6 Hours***
Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.	
Module 5: *Photogrammetry Surveying*	***6 Hours***
Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo-plotting instruments, mosaics, map substitutes.	
Module 6: *Remote Sensing*	***6 Hours***
Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.	
Total Practical hours	**36 hours**
Text Book(s)	
Surveying Vol I,II: Punmia, Jain & Jain, Laxmi Publications, 2016	
Surveying Vol I,II: S.K Duggal, McGraw Hill Education Pvt. Ltd, 2013	
Surveying and Levelling- N N Basak, McGraw Hill Education Pvt. Ltd, 2014	

Reference Books	
Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.	
Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.	
Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010	
Garg, P.K., Principles and Theory of Geoinformatics, Khanna Publishing House, 2019	

BCE23403T	GEOTECHNICAL ENGINEERING	L	T	P	C
		3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. To understand the behavior of soil and different methods of soil exploration.
2. To analyze the permeability and seepage quantities below the ground and the significance of effective stress and its relation with pore pressure.
3. To distinguish between consolidation and compaction and the factors affecting them.
4. To compute the vertical stresses and shear resistance of soil mass and check the slope stability.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the phase diagrams and derive various phase relationships of the soil.
2. Classify any soils based on their particle size distribution and index properties.
3. Determine the permeability of soils through various laboratory and field tests and plot the stress distribution diagrams along the depth of soil mass.
4. Determine the compactive effort required to obtain necessary degree of compaction of soil and various consolidation parameters of soil through laboratory test;
5. Evaluate the vertical stresses in semi-infinite soil mass and stiffness of soil using shear strength parameters.

Module:1 *Composition, Index Properties Classification of Soil* — **8 hours**

Types of soils, their formation and deposition, Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Index properties and phase relationship. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method and alcohol method; Specific gravity by density bottle method, pycnometer method and measuring flask method; Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method. Particle-size analysis. Consistency of soils and Atterberg's limits. Activity of clays. Soil classification according to grain size, according to plastic properties (IS classification).

Module:2 *Permeability of Soil* — **4 hours**

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. Introduction of Seepage Analysis, stream and potential functions, construction of flow nets.

Module:3 *Effective Stress Principle* — **4 hours**

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.

Module:4 *Compaction and Consolidation of Soil* — **8 hours**

Theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control, comparison between compaction and consolidation, initial, primary & secondary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Module:5 *Stresses in Soil* — **4 hours**

Introduction of stress, 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.

Module:6 *Shear strength of Soil* — **4 hours**

Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behavior of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters, unconfined compression test, vane shear test.

Module:7 *Stability of Slopes* — **2 hours**

Introduction of slope, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Module :8 *Soil Exploration* — **2 hours**

Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods.	
Total Lecture hours	**36 hours**
Text Book(s)	
1.	Basic and applied soil mechanics by Gopal Ranjan
2.	Soil mechanics and foundations by B.C.Punmia
Reference Books	
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
9.	Engineering (Civil and Environmental Engineering) by V.N.S. Murthy

BCE23404T	HYDRAULIC ENGINEERING	L	T	P	C
		3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. To know the different types of flow.
2. To understand the concept of boundary layer theory.
3. To Analyze flow through pipes and design simple pipe systems
4. To study the force of jet and the performance of turbines and pumps.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the various types of flow.
2. Evaluate the boundary layer thickness using the concept of boundary layer theory.
3. Understand the flow mechanism through pipes.
4. Evaluate the force of jet on stationary and moving plate.
5. Identify on the selection of turbines and pumps for practical purposes

Module:1 *Laminar Flow*	**6 hours**
Viscosity- dynamic and kinematic, Laminar flow through: circular pipes and parallel plates.	
Module:2 *Turbulent Flow*	**6 hours**
Definition of turbulence, causes and effect of turbulent flow in pipes, Smooth and rough pipes or surface, Prandtl's mixing length theory, velocity distribution for turbulent flow over smooth and rough surfaces, friction factor for smooth and rough pipes, Moody's diagram.	
Module:3 *Boundary Layer Analysis*	**8 hours**
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, momentum integral equation; computation of boundary layer thickness, shear stress and drag force for laminar and turbulent boundary layer.	
Module:4 *Flow through Pipes*	**10 hours**
Loss of head through pipes, Darcy-Weisbach equation, minor losses, total energy line, hydraulic gradient line, pipes in series, equivalent pipes, pipes in parallel, siphon, power transmission through pipes, analysis of pipe networks: Hardy Cross method, water hammer in pipes.	
Module:5 *Impact of Jet*	**3 hours**
Force of jet on stationary and moving flat plates, force of jet on hinged plate, force of jet on stationary and moving curved vanes (symmetrical and unsymmetrical).	
Module:6 *Introduction to Hydraulic Machines*	**3 hours**
Classification of hydraulic machines- Turbines and Pumps, Work done, power, heads and efficiencies of turbines and pumps.	
Total Lecture hours	**36 hours**

Text Book(s)

1. A Textbook of Fluid Mechanics and Hydraulic Machines- by R. K. Bansal.

Reference Books

1. Theory and Application of Fluid Mechanics - by K. Subramanya.
2. Hydraulics Fluid Mechanics and Fluid Machines - by S. Ramamrutham
3. Fluid Mechanics - by Frank M. White

BCE23405T	STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. To know various theorem and principles for analyzing statically determinate and indeterminate structures.
2. To study the concepts of structural analysis for statically determinate structures, arches, bridges and columns.
3. To study the analysis procedure of statically indeterminate structure by using force method.
4. To study the analysis procedure of statically indeterminate structure by using displacement method.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Determine deflection of statically determinate structures under various loading and support conditions.
2. Apply basic concepts of structural mechanics for the analysis of statically determinate structures.
3. Apply concept of Influence Line Diagram to statically determinate structures.
4. Analyze indeterminate structures by using force and displacement method.

Module:1 *General Theorems*	**4 hours**
Theorems relating to elastic structures, principle of virtual work, strain energy in elastic structures, complementary energy, Castigliano's theorems, Maxwell-Betti's reciprocal theorem.	
Module:2 *Deflection of statically determinate structures*	**5 hours**
Deflection of determinate beams by principle of virtual work (unit load method) and Castigliano's theorems, Deflection of determinate pin jointed trusses and rigid jointed frames by principle of virtual work (unit load method), Strain Energy and Castigliano's theorems	
Module:3 *Influence lines for statically determinate structures*	**5 hours**
Influence lines for cantilever beam, simply supported beam, overhanging beam and pin jointed trusses. Criteria for maximum shear force and bending moment under moving loads for simply supported beams, absolute maximum bending moment	
Module:4 *Elastic arches and Suspension bridges*	**5 hours**
Normal thrust, shear force and bending moment for parabolic and segmental three hinged arches. Influence lines for normal thrust, shear force and bending moment for three hinged parabolic arch. Suspension cable with three hinged stiffening girder. Influence line diagrams for horizontal tension in the cable, shear force and bending moment at any section of the stiffening girder.	
Module:5 *Column and Struts*	**5 hours**
Struts subjected to axial loads, concept of buckling. Euler's buckling theory of struts with different boundary conditions. Rankine's buckling theory for columns. Struts subjected to eccentric and lateral loads and struts with initial curvature.	
Module:6 *Analysis of indeterminate structures by flexibility method*	**6 hours**
Flexibility coefficients and their use in the formulation of compatibility equations. Application of Castigliano's theorem of least work to propped cantilevers, fixed beams, continuous beams, simple pin jointed frames	
Module:7 *Analysis of indeterminate structures by stiffness method*	**6 hours**
Stiffness coefficients and their use for formulation of equilibrium equation, direct stiffness method, slope deflection method, moment distribution method, applications of these methods to indeterminate beams, simple rigid jointed frames and rigid jointed frames with inclined members, including the effect of settlement/rotation of supports	
Total Lecture hours	**36 hours**

Text Book(s)

1.	C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2010. (ISBN-

	1283187140/978-1283187145).
2.	D. Menon, Structural Analysis Volume – I and II Narosa Publication, 2010. (ISBN- 978-1842653371/1842653377).
Reference Books	
1.	C.K. Wang, Intermediate Structural Analysis, McGraw Hill, 1984. (ISBN10:0070666237/978- 0070666238).
2.	S.S. Bhavikatti, Structural Analysis Volume – I, Vikas Publishers, 3rd edition, 2011. (ISBN: 9788125942696/8125942696).
3.	Gare and Weaver, Analysis of Framed Structure, CBS Publication, 2nd Edition, 2004. (ISBN:978-8123911519/8123911513).
4.	R.C.Hibbeler, Structural Analysis. Publisher: Pearson, 2017

BCE23406T	CONSTRUCTION ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. To know different construction features and project.
2. To obtain knowledge on different types of chart and network analysis.
3. To study the construction methods and equipments used.
4. To create construction project schedules.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand construction quality assurance and control.
2. Apply construction management skills as a member of a multi- disciplinary team.
3. Analyze methods, materials, and equipment used to construct projects.
4. Create construction project schedules.

Module:1 *Basics of Construction* — **1 hours**

Unique features of construction, construction projects-types and features, phases of a project, agencies involved and their methods of execution.

Module:2 *Construction project planning* — **10 hours**

Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion.

Module:3 *Construction Methods basics* — **5 hours**

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

Module:4 *Construction Equipment basics* — **4 hours**

Conventional construction methods v/s Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

Module:5 *Planning and organizing construction site and resources* — **5 hours**

- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of Balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

Module:6 *Project Monitoring & Control* — **6 hours**

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of

inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.	
Module:7 *Contracts Management basics*	**4 hours**
Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.	
Module:8 *Construction Costs*	**1 hours**
Construction costs, Classification of costs, timecost trade-off in construction projects, compression and decompression.	
Total Lecture hours	**36 hours**

Text Book(s)

1.	Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Reference Books

1.	Project Management- By Frederick Gould and Nancy Joyce.
2.	*National Building Code*, Bureau of Indian Standards, New Delhi, 2017.
3.	Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006.

MNC-AC	CIVIL ENGINEERING – SOCIETAL & GLOBAL IMPACT	L	T	P	C
		3	0	0	0

Pre-requisite: Nil

Course Objectives:

- Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
- Awareness of the impact of Civil Engineering for the various specific fields of human endeavour
- Need to think innovatively to ensure Sustainability

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. The impact of Civil Engineering projects on society and the global arena, emphasizing efficient and effective resource use.
2. The infrastructure's energy requirements and their evolution from past to present, and future projections.
3. The sustainability and aesthetics of the environment, ensuring positive impacts on the built environment and quality of life.
4. The role of Civil Engineering in employment creation, its contribution to GDP, and the importance of professional, responsible judgment and leadership.

Module:1 **6 hours**

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;

Module:2 **4 hours**

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

Module:3 **6 hours**

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;

Module:4 **7 hours**

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.

Module:5 **6 hours**

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

Module:6	**7 hours**

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;

Total Lecture hours	**36 hours**

Text Book(s)/ Reference Books

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. 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
12. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.
13. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.
14. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
15. 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

BCE23411P	TRANSPORTATION ENGINEERING LAB	L	T	P	C
		0	0	2	1

Pre-requisite: Nil

Course Objectives:

1. Equip students with practical skills in collecting, analyzing, and interpreting traffic data.
2. Develop students' ability to design and simulate transportation infrastructure projects.
3. Provide hands-on experience with testing and evaluating pavement materials.
4. Enable students to assess and improve the performance of transportation systems.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. To perform Sieve analysis, Impact test, Crushing Strength test.
2. To perform Index test, CBR test, Dynamic Cone Penetrometer (DCP) test.
3. To perform penetration test, Ductility determination and Viscosity determination of bitumen.
4. To perform softening Point determination, Flash and fire point determination.
5. To perform stripping value determination and Marshal Stability test.

List of Experiments

1. Sieve analysis [as per IS 2386 (Part I)-1963] and blending of aggregates by Triangulation and Rothfuchs Method
2. Combined Flakiness and Elongation Index test [as per IS 2386 (Part I)-1963]
3. Specific Gravity test of coarse and fine aggregates [as per IS 2386 (Part III)-1963]
4. Aggregate Impact Value test [as per IS 2386 (Part IV)-1963]
5. Los Angeles Abrasion Value test [as per IS 2386 (Part IV)-1963]
6. Aggregate Crushing value Test [as per IS 2386 (Part IV)-1963]
7. California Bearing Ratio (CBR) test [as per IS 2386 (Part XVI)-1987]
8. Dynamic Cone Penetrometer test [as per ASTM D6951/D6951M-09]
9. Penetration test on bitumen [as per IS: 1203-1978]
10. Ductility test on bitumen [as per IS: 1208 –1978]
11. Ring and Ball test for softening point determination [as per IS 1205-1978]
12. Flash and fire point determination using Pensky-Martens apparatus [as per IS: 1209 1978]
13. Striping value test of aggregates [as per IS: 6241-1971]
14. Saybolt Viscosity test on bitumen emulsion [as per ASTM D7496-11]
15. Marshal Stability test on bituminous mixes to determine optimum binder content [as per ASTM-D6927, ASTM-D5581]

BCE23412P	SURVEYING AND GEOMATICS LABORATORY	L	T	P	C
		0	0	2	1

Pre-requisite: Nil

Course Objectives:

- To operate an automatic level to perform differential and profile levelling; properly record notes, mathematically reduce and check levelling measurements.
- To measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments.
- To calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse.
- To calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

Expected Course Outcome:

- Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
- Translate the knowledge gained for the implementation of Civil infrastructure facilities.
- Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

Lists of Practical to be conducted:

Practical 1: Plane Table Survey
To carry out traverse by plane table surveying.

Practical 2: Horizontal and Vertical angle measurement
To measure horizontal angle with the method of repetition and vertical angle with theodolite and determine the height of an object with trigonometric levelling.

Practical 3: Traversing and Map Preparation
To carry out closed traverse with theodolite, prepare map of the area along with contour map using concepts of Gale's Traverse Table.

Practical 4: Curve Setting
To set a simple circular curve between two given straight roads by Rankine's Method

Practical 5: Traversing by using Prismatic Compass
To carry out open traverse by using prismatic compass.

Practical 6: Total Station and GPS
To carry out open traverse using Total Station and GPS.

Total Practical hours

Reference Books

Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.

Surveying and Levelling- N N Basak, McGraw Hill Education Pvt. Ltd, 2014

Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010

BCE23413P	GEOTECHNICAL ENGINEERING LAB	L	T	P	C
		0	0	2	1

Pre-requisite: Geotechnical Engineering Theory

Course Objectives:

1. To perform various laboratory experiments to determine moisture content and specific gravity and field experiment to estimate the field density of the soil mass.
2. To perform laboratory experiments to estimate the Atterberg limits of soil.
3. To determine the permeability of soils through various laboratory experiments.
4. To perform laboratory test to determine the maximum dry density and optimum moisture content of soil.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the behavior of soil based on their moisture contents.
2. Classify any soils based on their particle size distribution and index properties.
3. Understand the range of permeability values of different soil mass.
4. Understand the variation in compaction curve with compaction effort and soil type

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. Specific gravity of Soils.
5. Grain size distribution by Sieve Analysis
6. Determination of liquid limit, plastic limit and shrinkage limit.
7. Permeability test using Constant-head test method.
8. Permeability test using Falling-head method.
9. Compaction test: Standard Proctor test.

BCE23414P	HYDRAULIC ENGINEERING LAB	L	T	P	C
		0	0	2	1

Pre-requisite: Nil

Course Objectives:

1. To know the basic measurement techniques of hydraulics and hydraulic machines.
2. To obtain the results obtained in the laboratory for various experiments.
3. To study the practical working of different types of pumps and turbines.
4. To understand the results of analytical models introduced in lecture to the actual behavior of the machines.

Expected Course Outcome:

Upon completion of this course, the student will be able to

1. Understand the measurement of Reynold's Number and friction factor of pipe flow.
2. Identify the science of impact of jet.
3. Understand the practical applications of different hydraulic machines.
4. Understand the process of writing a technical laboratory report.

List of Experiments:

1. Determination of Reynold's number for laminar, turbulent and transition flow.
2. Determination of friction factor for a pipe flow.
3. Impact of a jet.
4. Study of performance characteristics of a Pelton Wheel Turbine.
5. Study of performance characteristics of a Centrifugal Pump.
6. Study of constructional details and performance parameters of Reciprocating Pump.
7. Study of constructional details and performance parameters of Kaplan Turbine.