

M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054



**RAMAIAH
UNIVERSITY**
OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: B. Tech. in Civil Engineering

Programme Code: 001

Programme Outcome (PO)

Programme Specific Outcome (PSO)

Program Educational Objectives (PEO)

Course Outcomes (CO)

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Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Registrar

M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

Approved in 23rd ACM (Resolution 23.05) held on 15th July 2021

Faculty of Life and Allied Health Sciences (FLAHS)

Programme Outcomes (POs)

Under Graduate Programme: B. Tech. (Civil Engineering)

B. Tech. graduates will be able to:

- PO-1. Apply knowledge of mathematics, science, basic engineering fundamentals and engineering specialization concerned for the solution of complex engineering problems
- PO-2. Identify, formulate and analyze engineering problems using first principles of mathematics, science and engineering to interpret data and reach substantiated conclusions
- PO-3. Provide solutions to engineering problems by designing systems, components or processes to meet the specified needs considering public health, safety, societal and the environmental considerations
- PO-4. Apply the knowledge of laboratory techniques and research methods to solve complex engineering problems through experimental investigations, analysis and interpretation of results
- PO-5. Gain proficiency in modelling complex engineering activities by selecting appropriate techniques and IT Tools and utilize available resources effectively
- PO-6. Understand the effect of engineering solutions on legal, cultural, social, public health and safety aspects and the consequent responsibilities
- PO-7. Develop sustainable engineering solutions and assess their effect on society and environment
- PO-8. Understand and apply ethical principles to engineering practices and professional responsibilities
- PO-9. Function effectively as an individual or a team player to handle diverse problems in multi-disciplinary settings
- PO-10. Make oral and written presentations to communicate technical ideas effectively to engineering community and society at large
- PO-11. Apply the knowledge of engineering and management principles to manage projects in multi-disciplinary environments with consideration to cost and time
- PO-12. Recognize and engage in lifelong learning to adapt to changing needs and advancements in technology

Programme Specific Outcomes (PSOs)

At the end of the B.Tech. (Civil Engineering) program, the graduate will be able to:

- PSO-1. Apply the knowledge of Civil engineering Analysis and Design in to develop efficient solutions for complex problems in Civil engineering and allied areas using analytical and cognitive skills.
- PSO-2. Design and develop sustainable solutions using Civil engineering principles, concepts, experimentation and appropriate tools to address industry and societal requirements



PSO-3. Demonstrate ethics, leadership qualities, communication, entrepreneurial skills and involvement in lifelong learning for the betterment of organization, environment and society

Program Educational Objectives (PEOs)

The Programme educational objectives of the B.Tech. (Civil Engineering) Programme are:

PEO-1. To provide students with knowledge in mathematics, science and core engineering area to enable them to deliver efficient solutions for complex engineering problems using analytical and cognitive skills

PEO-2. To enable students to design and develop the sustainable innovative solutions for industry and societal requirements by conducting engineering investigations through experimentation and usage of modern tools.

PEO-3. To inculcate ethics, communication, leadership, soft, managerial and entrepreneurial skills for successful career in industries and to engage in lifelong learning

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Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 1 (MTB101A)

After the successful completion of this course, the student will be able to:

- CO-1. State and discuss basic concepts related to single, two variable calculus and matrix algebra
- CO-2. Perform basic operations of matrix algebra and apply them to solve systems of linear equations
- CO-3. Solve simple mathematical problems associated with linear algebra, single and two variable calculus
- CO-4. Demonstrate competence with the basic ideas of linear systems, independence, bases and dimension, linear transformations, eigenvalues, eigenvectors and diagonalization
- CO-5. Solve complex real-world problems associated with linear algebra, single and two variable calculus

Course Outcomes (COs)

Course Title & Code: Engineering Physics and Laboratory (PYB102A)

After the successful completion of this course, the student will be able to:

- CO-1. State, explain the concepts of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- CO-2. Derive standard relationships in mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser & fiber optics, and interpret them
- CO-3. Discuss the applications of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- CO-4. Solve problems in mechanics, electrical conductivity, quantum mechanics, crystal structure, material science, laser and fiber optics
- CO-5. Plan the experimental set-up, conduct experiments, calculate and plot the Graphs to obtain the results and write a laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Engineering Mechanics (CEF101A)

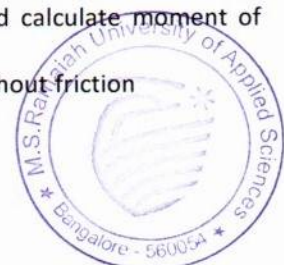
After the successful completion of this course, the student will be able to:

- CO-1. State and describe the laws of Statics, Friction and Dynamics and their contexts of application.
- CO-2. Interpret standard mathematical relationships and apply for solving problems when rigid bodies are subjected to different force systems
- CO-3. Apply the concepts of equilibrium for solving the problems on rigid bodies
- CO-4. Determine centroid/centre of gravity for various plane shapes and calculate moment of inertia for the structural members
- CO-5. Apply the laws of statics for the analysis of rigid bodies with and without friction

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Course Outcomes (COs)

Course Title & Code: Elements of Electronics Engineering and Laboratory (ECF102A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain working principles of PN junction diode, Zener diode, transistors, amplifier configurations, Op-Amps, power supply, logic gates and electronic displays
- CO-2. Derive mathematical relationships for electronic devices and circuits
- CO-3. Solve simple numerical and design problems related to analog / digital circuits as well as devices
- CO-4. Design and analyse operation of standard analog / digital circuits for a given application
- CO-5. Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
- CO-6. Interpret and compare with standard results, and draw conclusions and Write reports as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Engineering Drawing (MEF103A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the conventions used in projections of geometric entities and interpret the same
- CO-2. Draw orthographic projections for the geometric entities in specified positions
- CO-3. Develop lateral surfaces of un-sectioned and sectioned regular solids
- CO-4. Develop orthographic projections for given applications
- CO-5. Draw isometric projections for the solids and their combinations
- CO-6. Demonstrate competency in using CAD tool for drawing projections of geometric entities

Course Outcomes (COs)

Course Title & Code: Constitution, Human Rights and Law (LAN101A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain the key principles of the Indian Constitution
- CO-2. Explain Indian legal system and judicial structure that govern the citizens
- CO-3. Discuss UN Declaration of Human Rights
- CO-4. Discuss the scope and application of Human Rights Principles and Law
- CO-5. Suggest strategies for protection of human rights and resolving legal issues in compliance with applicable laws

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 2 (MTB102A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the fundamentals of ordinary differential equations and Laplace transform



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- CO-2. Solve standard forms of ordinary differential equations
- CO-3. Solve simple problems in ordinary differential equations and Laplace transform
- CO-4. Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations using Laplace transform
- CO-5. Apply Laplace transform in solving complex real world engineering problems

Course Outcomes (COs)

Course Title & Code: Engineering Chemistry and Laboratory (CYB104A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain the basic concepts of electrochemistry, conversion of chemical energy into electrical energy, theory of corrosion and principles of metal finishing
- CO-2. Differentiate renewable - nonrenewable fuels, primary - secondary electrodes & primary - secondary batteries, batteries - fuel cells, electroplating – electroless plating, thermosetting – thermoplastic polymers and dry corrosion - wet corrosion
- CO-3. Discuss the reaction chemistry and stoichiometry of combustion of fuels, remedial measures to control oxides of nitrogen, sulphur and carbon, polymerization – methods, mechanism, preparation, properties and applications of some polymers, concepts of nano science and nanotechnology
- CO-4. Identify the types of corrosion and methods to prevent corrosion, suitable polymers and nanocomposite materials for engineering applications
- CO-5. Derive kinetic rate equations for various chemical systems and equation for electromotive force
- CO-6. Analyze the suitability of polymers & composites for various applications and solve problems related to storage devices, chemical kinetics, electro chemistry, corrosion

Course Outcomes (COs)

Course Title & Code: Elements of Mechanical Engineering and Workshop Practice (MEF104A)

After the successful completion of this course, the student will be able to:

- CO-1. Demonstrate the understanding on Classification of energy sources, energy conversion systems, mechanical power transmission systems, machine tools and processes
- CO-2. Describe various energy conversion systems, mechanical power transmission systems and machine tools
- CO-3. Explain the working principle of refrigeration systems, biomass conversion technologies and machining operations
- CO-4. Solve numerical problems on IC engines and mechanical power transmission systems
- CO-5. Apply principles of energy conversion systems, power transmission systems, machining processes and mechanical joints to practical applications

∞ Course Outcomes (COs)

Course Title & Code: Elements of Electrical Engineering and Laboratory (EEF105A)

After the successful completion of this course, the student will be able to:

- CO-1. State and explain various laws of electric circuits, magnetic circuits and their



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- significance, phasor diagrams for electrical elements
- CO-2. Explain construction, principle of operation, working and characteristics of DC machines, transformers, AC rotating machines and their applications
 - CO-3. Derive equations for electrical circuits, magnetic circuits and performance of various AC and DC machines
 - CO-4. Solve problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines
 - CO-5. Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
 - CO-6. Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Elements of Computer Science and Engineering and Laboratory (CSF106A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the elements and methodology of Computer Science and Engineering
- CO-2. Explain the basic principles and techniques of algorithms and programming
- CO-3. Select appropriate approach to solve a computational problem
- CO-4. Design an algorithmic solution and draw a flow chart of the solution
- CO-5. Develop computer programs for moderately complex problems
- CO-6. Test and validate developed computer programs

Course Outcomes (COs)

Course Title & Code: Professional Communication (TSN102A)

After the successful completion of this course, the student will be able to:

- CO-1. Apply the concepts of grammar for communication
- CO-2. Compose precise paragraphs
- CO-3. Demonstrate professional etiquette
- CO-4. Demonstrate appropriate verbal and non-verbal communication in the given context
- CO-5. Develop professional written document

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 3 (MTB201A)

After the successful completion of this course, the student will be able to:

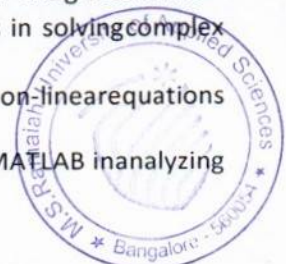
- CO-1. State and explain the important theorems in Fourier series, Fourier transform and vector integral calculus
- CO-2. Solve simple problems in Fourier series, Fourier transform and vector integral calculus
- CO-3. Apply Fourier series, Fourier transform and vector integral calculus in solving complex real world engineering problems
- CO-4. Implement the programs to solve system of linear equations and non-linear equations of single variable using MATLAB.
- CO-5. Apply interpolation and curve fitting by least square method using MATLAB in analyzing some real world problems



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Course Outcomes (COs)

Course Title & Code: Mechanics of Solids (CEC202A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the basic concepts of the stresses and strains for different materials and strength of structural elements
- CO-2. Explain stress strain behaviour of materials, axial forces, bending, torsion, shear force, bending moment, principal stresses and strains, shear force diagram, bending moment diagram and thin vessels.
- CO-3. Determine shear force and bending moment, bending and shear stress distribution, principal stresses and planes, and strain energy
- CO-4. Calculate load carrying capacity of members subjected to bending/shear/torsion/axial force analytically
- CO-5. Analyse and design members subjected to combined bending, torsion and axial forces.

Course Outcomes (COs)

Course Title & Code: Mechanics of Fluids (CEC203A)

After the successful completion of this course, the student will be able to:

- CO-1. State and justify important laws of fluid mechanics like Hydrostatic law, Pascal's law, Continuity Equations, Bernoulli's Theorem, Darcy's Law and explain different fluid flows and the dynamics involved
- CO-2. Discuss and estimate the parameters related to physical properties and characteristic behaviour of fluids, open and closed conduit flows along with their losses
- CO-3. Determine hydrostatic pressure at any depth on any immersed surface in a fluid or fluid combinations
- CO-4. Solve fluid flow problems like flow through ducts, venturimeter, orifices, open channel and closed conduit flows.
- CO-5. Predict the discharge across open channels using weirs, notches and flumes

Course Outcomes (COs)

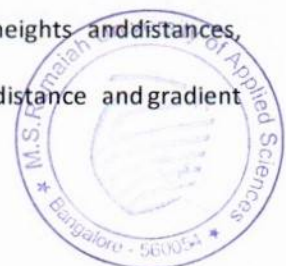
Course Title & Code: Engineering Survey (CEC204A)

After the successful completion of this course, the student will be able to:

- CO-1. Measure distance between two stations, procedure to set out perpendiculars at various points on a given line and polygons using tapes and chains and other accessories
- CO-2. Develop and plot the various features on the ground using various methods of plane table surveying
- CO-3. Determine the elevations using various methods and also identify a suitable method for a given case
- CO-4. Determine horizontal and vertical angles by different methods, heights and distances, closing errors in traversing, areas and volume
- CO-5. Determine tachometric constant, measure elevation, horizontal distance and gradient between given points
- CO-6. Setting out simple curves by suitable methods

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Course Outcomes (COs)

Course Title & Code: Engineering Geology and Properties of Soils (CEC205A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain the branches of Geoscience having a relevance to civil engineering.
- CO-2. Classify and describe some of the common rocks and minerals of the Earth's Crust.
- CO-3. Discuss the geo-scientific factors responsible for triggering of Earthquakes, landslides, tsunami besides under the surface geological processes having a great relevance to civil engineering.
- CO-4. Explain the basic concepts of Geo-hydrology, Soil study (Pedology), Marine Geology, environmental geology and Remote sensing in various civil engineering applications.
- CO-5. Apply and integrate some of the basic geoscientific concepts and principles in Engineering site selection and construction.

Course Outcomes (COs)

Course Title & Code: Building Materials Concrete and Construction Technology (CEC206A)

After undergoing this course students will be able to:

- CO-1. Describe components of concrete, fresh and hardened properties, and manufacturing process of concrete
- CO-2. Classify and explain construction, casting and curing procedure of various components in a building
- CO-3. Discuss the substructure requirements and preliminary investigations of soil
- CO-4. Discuss the suitability of plastering, painting, Flooring materials and types of roofs
- CO-5. Design the geometry of isolated, strap and combined footing
- CO 6. Design the concrete mix as per Indian standard

Course Outcomes (COs)

Course Title & Code: Material Testing Laboratory (CEL207A)

After the successful completion of this course, the student will be able to:

- CO-1. Conduct tests to evaluate the tension, compression, torsion and shear parameters of mild steel and aluminum
- CO-2. Perform bending test on wood, impact test on mild steel and hardness tests on ferrous and nonferrous metals
- CO-3. Explain fatigue tests, strain gauges and strain indicators
- CO-4. Generate Evaluate characteristic properties of construction materials such as aggregates, tiles and bricks
- CO-5. Recommend the suitability of the materials based on results obtained from the tests

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Course Outcomes (COs)

Course Title & Code: Survey Practice (CEL208A)

After the successful completion of this course, the student will be able to:

- CO-1. Measure distance between two stations, procedure to set out perpendiculars at various points on a given line and polygons using tapes and chains and other accessories.
- CO-2. Develop and plot the various features on the ground using various methods of plane table surveying
- CO-3. Determine the elevations using various methods and also identify a suitable method for a given case.
- CO-4. Determine horizontal and vertical angles by different methods, heights and distances, closing errors in traversing, areas and volume
- CO-5. Determine tacheometric constant, measure elevation, horizontal distance and gradient between given points.
- CO-6. Setting out simple curves by suitable methods.

Course Outcomes (COs)

Course Title & Code: Applied Engineering Geology Laboratory (CEL209A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the physical properties aiding field identification of some of the common rocks and minerals
- CO-2. Read the topographic maps with respect to physiographic details, natural and cultural features
- CO-3. Read the geological maps with respect to rock and soil distribution, primary structural patterns as well as deformational structures aiding preparation of geological cross section and interpretation.
- CO-4. Graphically represent the surface geological details in determination of subsurface thickness, depth of persistence and inclination; includes validation of results by trigonometric method.
- CO-5. Determine the Strike and dip component (True and Apparent) of rocks graphically with the drilling data and surface measurements

Course Outcomes (COs)

Course Title & Code: Environmental Studies (BTN101A)

After the successful completion of this course, the student will be able to:

- CO-1. Illustrate the multidisciplinary nature of environmental studies and recognize the need for public awareness
- CO-2. Explain the various natural resources and their associated problems, ecosystem, and environmental pollution
- CO-3. Analyse the concept of ecosystem and classify various types
- CO-4. Compare biodiversity at local, national and global levels
- CO-5. Discuss various social issues pertaining to environment including sustainable development and energy issues



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Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 4 (MTB211A)

After the successful completion of this course, the student will be able to:

- CO-1. Define and explain the concepts of correlation, regression, random variables, probability distribution, partial differential equations and complex analysis
- CO-2. State theorems and solve simple problems in partial differential equations, complex analysis, probability, probability distributions
- CO-3. Apply numerical methods to solve ordinary and partial differential equations using MATLAB
- CO-4. Solve complex engineering problems associated with numerical methods using MATLAB
- CO-5. Analyze real world problems associated with probability, probability distributions, partial differential equations and complex analysis
- CO-6. Construct the Bar chart, pie chart, Histogram, Box-plot and fitting of curves by using MATLAB

Course Outcomes (COs)

Course Title & Code: Transportation Engineering - I (CEC212A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the Highway Development Programme and the basic principles of planning for achieving them
- CO-2. Identify and discuss pavement components and the types of pavement construction
- CO-3. Conduct tests and evaluate the properties of pavement materials
- CO-4. Explain highway geometrics and structural designs for flexible and rigid pavements
- CO-5. Analyse economics of highway projects and compare alternatives from an economic point of view

Course Outcomes (COs)

Course Title & Code: Structural Analysis-I (CEC213A)

After the successful completion of this course, the student will be able to:

- CO-1. Define and describe various structural forms and relevant concepts that can be applied for structural analysis
- CO-2. Determine deflections in determinate structures
- CO-3. Analyze arches and cable suspension bridges
- CO-4. Analyze determinate structures by applying the concepts of strain energy and force methods
- CO-5. Derive influence line diagrams for beams and explain their behavior under the effect of rolling loads



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Course Outcomes (COs)

Course Title & Code: Hydraulics and Hydraulic Machines (CEC214A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe fluid flow patterns and boundary layer theory
- CO-2. Apply the concepts of dimensional analysis to model hydraulic
- CO-3. Design the most economical section for uniform open channel flow
- CO-4. Analyze non-uniform flow in open channel flow
- CO-5. Evaluate the work done due to impact of jet on surfaces for different conditions
- CO-6. Discuss the theory, working principles and performance characteristics of various hydraulic machines

Course Outcomes (COs)

Course Title & Code: Environmental Engineering (CEC215A)

After the successful completion of this course, the student will be able to:

- CO-1. Identify the sources of water and water demand
- CO-2. Prepare basic process designs of water and wastewater treatment plants, collect, Reduce, analyze, and evaluate basic water quality data
- CO-3. Apply the water treatment concepts and methods
- CO-4. Compare and contrast water distribution processes and operation and maintenance of Water supply
- CO-5. Analyze the sewage characteristics and design various sewage treatment plants
- CO-6. Design and operate municipal water and wastewater treatment system

Course Outcomes (COs)

Course Title & Code: Environmental Engineering (CEC215A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain the various aspects of building services and green construction
- CO-2. Discuss the various components of the residential and public buildings as per NBC
- CO-3. Develop schematic diagram for a given requirement of areas and specification for residential and public buildings
- CO-4. Develop functional design of a building using circulation diagrams
- CO-5. Develop functional design of a building using circulation diagrams
- CO-6. Develop water supply, sanitary, and electrical layout for residential buildings

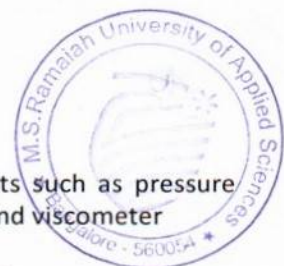
Course Outcomes (COs)

Course Title & Code: Hydraulics and Hydraulic Machinery Laboratory (CEL217A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe and explain pressure and viscosity measuring instruments such as pressure gauge, piezometer, manometer, pressure transducers, pitot tubes and viscometer
- CO-2. Determine friction and minor losses in flow through pipes
- CO-3. Conduct tests on flow measuring devices such as notches, orifices, mouthpieces, venturimeter and orificemeter

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- CO-4. Generate performance characteristic curves of Pelton, Francis and Kaplan turbines and centrifugal and reciprocating pumps
- CO-5. Validate Bernoulli's theorem

Course Outcomes (COs)

Course Title & Code: Environmental Engineering Laboratory (CEL218A)

After the successful completion of this course, the student will be able to:

- CO-1. Quantify the pollutant concentration in water, wastewater and ambient air
- CO-2. Recommend the degree of treatment required for the water and wastewater
- CO-3. Analyze the survival conditions for microorganisms and its growth rate

Course Outcomes (COs)

Course Title & Code: Concrete and Highway Materials Laboratory (CEL219A)

After undergoing this course students will be able to:

- CO-1. Explain the experimental setup and procedures to determine the characteristic properties of Concrete and Transportation materials
- CO-2. Calculate the required parameters of properties and strength and plot the results
- CO-3. Conduct experiments as per the standard procedures and tabulate the determined values
- CO-4. Write laboratory report as per the prescribed format
- CO-5. Recommend the suitability of the materials based on results obtained from the tests

Course Outcomes (COs)

Course Title & Code: Innovation and Entrepreneurship (BAU201A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain the concepts and process of Innovation as well as entrepreneurship
- CO-2. Construct and apply the idea generation techniques
- CO-3. Discuss the opportunities for launching of new venture and various entry strategies
- CO-4. Examine innovative ideas for the creation and management of entrepreneurship
- CO-5. Formulate and present a viable business plan to the investors appraisal

Course Outcomes (COs)

Course Title & Code: Design of RCC Elements (CEC301A)

After the successful completion of this course, the student will be able to:

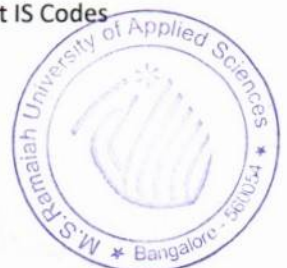
- CO-1. Describe fundamental concepts of working stress method, ultimate load method and limit state method
- CO-2. Estimate loads acting on beams, slabs, columns and staircase as per IS 875
- CO-3. Analyze load carrying capacity of beams, slabs, columns and staircases
- CO-4. Design of concrete elements like beams, slabs, stairs, column using relevant IS Codes
- CO-5. Design of structural system with neat sketches for drafting



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Course Outcomes (COs)

Course Title & Code: Structural Analysis-II (CEC302A)

After the successful completion of this course, the student will be able to:

- CO-1. Use various classical displacement and force methods for analysis of indeterminate structures
- CO-2. Apply the basic concepts of matrix methods in structural analysis develop stiffness and flexibility matrices
- CO-3. Analyze structures using flexibility and stiffness method
- CO-4. Conduct dynamic analysis for SDOF systems
- CO-5. Analyze structural system and interpret data.

Course Outcomes (COs)

Course Title & Code: Geotechnical Engineering-1 (CEC303A)

After the successful completion of this course, the student will be able to:

- CO-1. Outline the origin of soils and summarize the various properties of soils and their inter relationships
- CO-2. Classify various types of soils based on index properties
- CO-3. Interpret the soil behaviour based on engineering properties like permeability, shear strength and consolidation
- CO-4. Solve problems on the various index and engineering properties
- CO-5. Analyze practical problems and use software tools to solve the problems

Course Outcomes (COs)

Course Title & Code: Hydrology and Irrigation Engineering (CEC304A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe hydrologic cycle, precipitation, losses from precipitation and water logging and types of aquifers and aquifer characteristics
- CO-2. Explain runoff and its characteristics, water logging, reservoir characteristics, hydraulic structures and soil-water-crop relationships
- CO-3. Discuss hydrograph analysis, floods, well hydraulics, irrigation techniques and spillways
- CO-4. Compute mean precipitation, infiltration losses, inflow and outflow hydrograph (flood routing), reservoir capacity, safe yield from reservoir, crop water requirement and Irrigation efficiencies
- CO-5. Design gravity dam and earthen dam

Course Outcomes (COs)

Course Title & Code: Transportation Engineering-II (CEC315A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe various modes of transportation systems and explain their significance and development



- CO-2. Explain various terminologies related to railway, airport, harbor and tunnel engineering
- CO-3. Identify railway, airport, harbor and tunnel components and the factors influencing their geometric design
- CO-4. Discuss the appropriate alignment plan for railways and tunnels and layout of airports and harbors
- CO-5. Propose suitable geometrical designs and technologies to be adopted for the construction processes and maintenance of the same

Course Outcomes (COs)

Course Title & Code: Drawing of RCC Structures (CEC306A)

After the successful completion of this course, the student will be able to:

- CO-1. Draw RCC structures like beams, slabs
- CO-2. Draw RCC structures like columns, footings and stair-cases
- CO-3. Design and draw Portal Frames subjected to gravity loads
- CO-4. Design and draw water tanks resting on ground using IS codes
- CO-5. Develop Bar-Bending Schedule for beams, slabs
- CO-6. Develop Bar-Bending Schedule for columns, footings and stair-cases

Course Outcomes (COs)

Course Title & Code: Geotechnical Engineering Laboratory (CEL307A)

After the successful completion of this course, the student will be able to:

- CO-1. Identify and explain various equipment and procedures concerned with the evaluation of soil properties and its strength parameters
- CO-2. Arrive at grain size distribution of soils by sieve analysis
- CO-3. Determine consistency limits, free swell index, swell pressure of soil and relative density of sands
- CO-4. Determine in situ density of soil by core cutter and sand replacement methods and coefficient of permeability by constant head and variable head methods
- CO-5. Evaluate strength parameters of soils by Unconfined Compression test, Direct Shear test, Triaxial Compression test, Vane Shear test and CBR test
- CO-6. Prepare consolidated report of index properties and strength properties of soil

Course Outcomes (COs)

Course Title & Code: Extensive Survey Viva Voce (CEL308A)

After the successful completion of this course, the student will be able to:

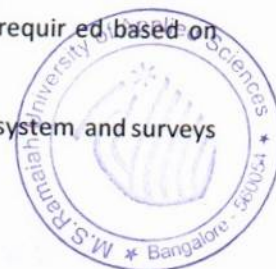
- CO-1. Set out curves, buildings, culverts and tunnels
- CO-2. Plan a survey for applications such as road alignment and height of the building
- CO-3. Plan a survey for applications for new tank, old tank and highway project
- CO-4. Examine the sources of water supply, calculation of quantity of water required based on existing and projected population
- CO-5. Prepare village map by any suitable method of surveying
- CO-6. Locate sites for ground level and overhead tanks, underground drainage system and surveys for laying the sewers



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Course Outcomes (COs)

Course Title & Code: Seminar (CES301A)

After the successful completion of this course, the student will be able to:

- CO-1. Prepare and deliver a seminar on a given topic
- CO-2. Write a report on the seminar topic

Course Outcomes (COs)

Course Title & Code: Geotechnical Engineering-II (CEC311A)

After the successful completion of this course, the student will be able to:

- CO-1. Identify and interpret different methods of subsurface exploration, lateral earth pressure, stability of slopes, bearing capacity of soils and settlement of foundations and evaluate parameters related to the above topics
- CO-2. Discuss different methods of computing stresses in soil and estimate them for different load conditions
- CO-3. Explain dewatering techniques applicable to different soil conditions and sketch phreatic line for an Earthen dam
- CO-4. Solve the problems related to stresses in soil mass, earth pressure acting on retaining walls, Bearing capacity of soils, factors of safety in soil slopes, soil exploration.
- CO-5. Predict the settlements for a given substructure and soil parameters and discuss the field Methods to determine them

Course Outcomes (COs)

Course Title & Code: Design of Steel Elements (CEC312A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain the concepts of plastic analysis and IS code practice for the design
- CO-2. Analyze the behavior and strength of bolted and welded connections
- CO-3. Calculate the strength of tension, compression and flexural members
- CO-4. Design the bolted and welded connection
- CO-5. Analyze and design the tension, compression, flexural members and column bases

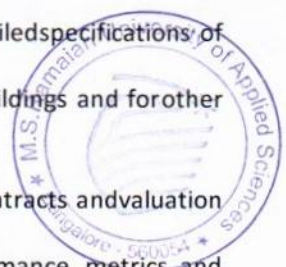
Course Outcomes (COs)

Course Title & Code: Estimation - Costing and Engineering Economics (CEC313A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain different types of estimates, units of measurement, and detailed specifications of common items of building works
- CO-2. Prepare abstract and detailed estimates for various components of buildings and for other structures
- CO-3. Perform rate analysis of various items of construction works.
- CO-4. Describe important contractual terms, procedures, various types of contracts and valuation of properties
- CO-5. Discuss accounting principles, financial statements, financial performance metrics, and

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inventory control for managing construction companies.

Course Outcomes (COs)

Course Title & Code: DSM & Finite Element Analysis (CEC314A)

After the successful completion of this course, the student will be able to:

- CO-1. Explain basic concepts, direct stiffness method of analysis background review, theory of elasticity, energy concepts, equilibrium and energy methods for analyzing structures
- CO-2. Discuss and derive Interpolation models, shape function and Lagrange's shape functions in different coordinate system for one and two dimensional elements
- CO-3. Derive shape functions, strain displacement matrix and element stiffness matrices for DSM and finite element analysis
- CO-4. Solve one and two dimensional problems by Direct Stiffness Method and Finite element method
- CO-5. Recognize the scope for finite element analysis in sub-disciplines of civil engineering

Course Outcomes (COs)

Course Title & Code: Design and Drawing of Transportation and Irrigation Structures (CEC315A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the geometric design characteristics of highways, classification of bridges and standard loads, types of bridges, forces to be considered for the design, IRC standards
- CO-2. Describe components of hydraulic structures
- CO-3. Determine the design discharge, afflux, economic span, natural, artificial and linear water ways
- CO-4. Design and draw the details of surplus weir, tank plug sluice, notch type canal drop and canal cross regulator
- CO-5. Design and draw the details of a pier/abutment of a bridge, RC slab culvert and RCT beam bridge

Course Outcomes (COs)

Course Title & Code: Design and Drawing of Geotechnical and Environmental Structures (CEC316A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the design concepts of sub structures
- CO-2. Discuss the layout of water treatment plants, types of river intake structures and pump house
- CO-3. Discuss the air pollution control systems, particulate and gaseous pollutant control
- CO-4. Design and draw the retaining walls, shallow and pile foundations
- CO-5. Design and prepare drawings of components of water and effluent treatment


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Course Outcomes (COs)

Course Title & Code: Design and Drawing of Steel Structures (CEC317A)

After the successful completion of this course, the student will be able to:

- CO-1. Draw the detailing of welded and bolted connections
- CO-2. Draw the detailing of splices, built-up columns and column bases
- CO-3. Analyze the Gantry girder, Plate girder and Roof truss
- CO-4. Design and detail the gantry girder, plate girder and truss roof

Course Outcomes (COs)

Course Title & Code: Computer Aided Design Laboratory (CEL318A)

After the successful completion of this course, the student will be able to:

- CO-1. Develop computer programs to solve civil engineering problems
- CO-2. Perform civil engineering calculations using spread sheets
- CO-3. Analyze various civil engineering structure in suitable software
- CO-4. Design various structural elements using suitable software
- CO-5. Prepare design report for structural components

Course Outcomes (COs)

Course Title & Code: Traffic Engineering (CEE311A)

After undergoing this course students will be able to:

- CO-1. Describe various components of road traffic and their characteristics
- CO-2. Explain data collection, analysis and interpretation of results for various traffic studies
- CO-3. Discuss various traffic regulations and traffic control devices
- CO-4. Design traffic signals and other traffic facilities
- CO-5. Plan various traffic management measures like one-way, reversible lanes, carpool lanes, etc.
- CO-6. Justify the application of Intelligent Transport System for present traffic scenario

Course Outcomes (COs)

Course Title & Code: Advanced Structural Analysis (CEE312A)

After the successful completion of this course, the student will be able to:

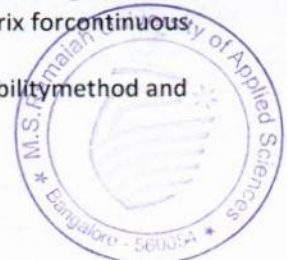
- CO-1. Describe the concepts of stiffness and flexibility methods
- CO-2. Obtain element flexibility and element stiffness matrices for truss, beam and gridelements
- CO-3. Develop the force transformation and displacement transformation matrix for continuous beams, plane trusses and rigid plane frames
- CO-4. Analyse continuous beams, plane trusses and rigid plane frames by flexibility method and stiffness method
- CO-5. Validate FEA tools for analysis of structures

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Course Outcomes (COs)

Course Title & Code: **Advanced Surveying -Remote Sensing and GIS (CEE312A)**

After the successful completion of this course, the student will be able to:

- CO-1. Describe basic concepts of remote sensing and GIS
- CO-2. Explain remote sensing system, raster and vector data structures, buffering and overlaying techniques
- CO-3. Discuss image processing techniques, digital elevation model , raster and vectordata structure, data storage and analysis in GIS
- CO-4. Discuss applications of remote sensing and GIS in Civil Engineering
- CO-5. Apply remote sensing and GIS techniques to evaluate and solve real worldproblems
- CO-6. Use suitable software to train in applications of GIS

Course Outcomes (COs)

Course Title & Code: **Advanced Concrete Technology (CEE314A)**

After the successful completion of this course, the student will be able to:

- CO-1. Identify the different components of concrete and discuss their properties
- CO-2. Compare and contrast different technologies involved in the process of manufacture of concrete, the concreting process along with durability aspects of concrete
- CO-3. Explain the principles, methods and factors involved in the mix proportioning of concrete and their influence on mix design
- CO-4. Discuss the different types of destructive and nondestructive tests on hardened concrete
- CO-5. Design different mixes of concrete as per IS, ACI and BS Codes for both insitu and readymix concretes
- CO-6. Recommend suitable type of concrete for a given set of conditions and propose relevant special concretes

Course Outcomes (COs)

Course Title & Code: **Solid Waste Management (CEE315A)**

After the successful completion of this course, the student will be able to:

- CO-1. Define solid waste and land pollution.
- CO-2. Describe sources, collection and transportation of solid waste.
- CO-3. Explain treatment / processing techniques of solid waste, disposal methods, recycle and reuse of solid waste
- CO-4. Explain the concept of incineration and composting process.
- CO-5. Design incineration chambers and sanitary land fillings.

Course Outcomes (COs)

Course Title & Code: **Ground Improvement Techniques (CEE316A)**

After undergoing this course students will be able to:

- CO-1. Describe the problems associated with the problematic soils and their significance in design
- CO-2. Outline the various soil improvement techniques adopted in the field
- CO-3. Discuss the concept of preloading and prefabricated vertical drains(PVDs)



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- CO-4. Explain the concept of reinforced earth, its mechanism and strength development
- CO-5. Apply the various ground improvement techniques to problematic soils

Course Outcomes (COs)

Course Title & Code: Project Work - 1 (CEP401A)

After the successful completion of this course, the student will be able to:

- CO-1. Recognise the need for developing a new or improving an existing engineering product/system through an organised survey of literature
- CO-2. Define engineering design specifications
- CO-3. Design, model, solve, analyse the product/system to meet the design specifications
- CO-4. Evaluate the performance of the modelled system and justify its performance
- CO-5. Demonstrate the system working in a virtual environment and make a presentation
- CO-6. Write a technical report

Course Outcomes (COs)

Course Title & Code: Internship (CEI401A)

After the successful completion of this course, the student will be able to:

- CO-1. Write a report on experiences during internship
- CO-2. Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Pavement Materials, Equipment and Construction (CEE411A)

After the successful completion of this course, the student will be able to:

- CO-1. Discuss the basics of soil, aggregates and bituminous materials required for pavement engineers
- CO-2. Explain the various engineering properties of soil, aggregates and bituminous materials required as per specifications
- CO-3. Discuss the construction steps, techniques and quality checks involved in pavement construction as per standard specifications
- CO-4. Discuss the working principle, operation and management of various pavement construction equipment

Course Outcomes (COs)

Course Title & Code: Pre-stressed Concrete Technology (CEE412A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the basic mechanisms of prestressing and types of prestressing
- CO-2. Calculate the internal forces due to the prestressing in a prestressed concrete structure, and to identify the primary and secondary components of the total internal forces
- CO-3. Compute the initial and time dependent losses in prestressing members



- CO-4. Analyse the stress, deflections, flexural and shear strength and apply it for the design of prestressing structures
- CO-5. Evaluate the prestressing force needed and its eccentricity for beams
- CO-6. Propose an appropriate system to prestress a particular structure and recommend suitable type of concrete for a given set of conditions

Course Outcomes (COs)

Course Title & Code: Advanced Hydrology (CEE413A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe hydrologic cycle, water budget equation and hydrologic processes
- CO-2. Explain atmospheric, surface and sub-surface hydrology
- CO-3. Discuss unit hydrograph method and hydrologic statistics
- CO-4. Develop hydrologic simulation model to address real world problem
- CO-5. Apply knowledge of hydrology to field problems

Course Outcomes (COs)

Course Title & Code: Green Construction and Alternate Building Materials (CEE414A)

After undergoing this module students will be able to:

- CO-1. Discuss the green concepts, components of sustainable design and construction, modern, green and alternate building materials.
- CO-2. Discuss building economics and cost-effective design for green construction
- CO-3. Apply sustainable techniques in planning and execution of construction projects
- CO-4. Compare and contrast different equipment's and construction techniques adopted in the construction of substructures, superstructures and special structures
- CO-5. Compare and choose different alternate building materials and technologies suitable for a particular construction projects
- CO-6. Design green building and construction process

Course Outcomes (COs)

Course Title & Code: Air Pollution and Control (CEE415A)

After undergoing this course students will be able to:

- CO-1. Explain formation pollutants and classify air pollutants
- CO-2. Describe meteorology, sampling, analysis and control
- CO-3. Explain effects of air pollution on environment and Human along with case studies.
- CO-4. Explain emerging trends in air pollution and its control
- CO-5. Identify and explain burning environmental issues along with environmental Legislation.

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Course Outcomes (COs)

Course Title & Code: Advanced Foundation Engineering (CEE416A)

After the successful completion of this course, the student will be able to:

- CO-1. Relate the significance of soil exploration and the types of foundation in practice
- CO-2. Summarize the concepts of soil dynamics and its application in machine foundations
- CO-3. Outline the problems of foundations in expansive soils and recommend solutions
- CO-4. Discuss the concept of Mechanically Stabilized Earth and earth retaining structures
- CO-5. Solve problems on ultimate load bearing capacity of vertical and laterally loaded piles, earth pressures and machine foundations

Course Outcomes (COs)

Course Title & Code: Urban Transport Planning (CEE421A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the role & characteristics of transportation and the concepts of travel demand
- CO-2. Analyze trip generation through interviews and models
- CO-3. Analyze trip distribution through various models
- CO-4. Perform trip assignment and mode split analysis through different methods

Course Outcomes (COs)

Course Title & Code: Advanced Design of Reinforced Concrete Structures (CEE422A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe design procedures for RCC structures
- CO-2. Explain IS code practice for the design of RC structures
- CO-3. Analyze Silos and bunkers using Janssen's Theory and Airy's Theory
- CO-4. Analyze slabs by virtual work and equilibrium methods of analysis
- CO-5. Design RCC structures like Deep beams, Chimneys, Flat slabs, Grid floor slabs and simple cylindrical shell

Course Outcomes (COs)

Course Title & Code: Watershed Management (CEE423A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe basic concepts in watershed management
- CO-2. Explain sustainable integrated watershed and water resources management and watershed management practices with case studies
- CO-3. Discuss various hydrological process models, management of water quality, stormwater, flood and draught with prospective of water recycle and reuse
- CO-4. Design urban drainage system
- CO-5. Discuss social aspects of watershed management with case studies



Course Outcomes (COs)

Course Title & Code: Construction Management and Engineering Economics (CEE424A)

After the successful completion of this course, the student will be able to:

- CO-1. Identify and explain the concepts of construction projects, project management functions, Legal and regulatory requirements, and administration of contract
- CO-2. Solve scheduling and tracking problems of a construction project using suitable techniques
- CO-3. Discuss the procedures involved in undertaking technical, financial, economic and ecological feasibility studies for the preparation of construction project report.
- CO-4. Evaluate a construction project using economical methods like present worth, annual worth and future worth to develop the scope of work, plan various activities involved in a construction project, and optimize the construction projects using Big-M method
- CO-5. Optimize the construction projects using Simplex and transportation techniques
- CO-6. Prepare the tendering and contracting documents for infrastructure development projects covering technical, commercial and legal aspects

Course Outcomes (COs)

Course Title & Code: Environmental Impact Assessment (CEE425A)

After the successful completion of this course, the student will be able to:

- CO-1. Define and describe the concept of environmental impact and Life cycle Assessment.
- CO-2. Describe methods for impact Identification along with Environmental indices and indicators.
- CO-3. Explain the factors considered in impact assessment of water related projects, waste watertreatment facilities.
- CO-4. Explain status of EIA in India and carbon trading.
- CO-5. Discuss prediction, assessment and it's on environment including visual impacts along with case studies.

Course Outcomes (COs)

Course Title & Code: Reinforced Soil Structures (CEE426A)

After the successful completion of this course, the student will be able to:

- CO-1. Describe basics of reinforced soil construction, mechanism, components and applications
- CO-2. Explain Geosynthetics, their functions and applications
- CO-3. Analyse and design a soil nailed structure
- CO-4. Discuss the design philosophies of reinforced soil retaining wall, reinforced soil foundation and design them
- CO-5. Discuss the filter criteria of Geosynthetics and their role in Landfills
- CO-6. Design reinforced soil slopes and reinforced soil pavements



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Course Outcomes (COs)

Course Title & Code: Project Work - 2 (CEP402A)

After the successful completion of this course, the student will be able to:

- CO-1. Recognise the need for developing a new or improving an existing engineering product/system through an organised survey of literature
- CO-2. Define engineering design specifications
- CO-3. Design, model, solve, analyse the product/system to meet the design specifications
- CO-4. Evaluate the performance of the modelled system and justify its performance
- CO-5. Demonstrate the system working in a virtual environment and make a presentation
- CO-6. Write a technical report



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