Department of Civil Engineering

Course Outcome (CO)

First Year -2019Course			
Semester I			
Course Code	**Course Name**	**Course Outcomes**	
101007	**Audit Course: Environmental Studies-I**	CO1	**Students will get the knowledge of various environmental issues and sustainability.**
		CO2	**Students will understand the ecosystem, role of organism and food chain.**
		CO3	**Get knowledge about conventional and non-conventional energy sources.**
		CO4	**Students can understand concept of biodiversity and its conservation.**
101011	**Engineering Mechanics**	CO 1	**Determine resultant of various force systems**
		CO 2	**Determine centroid, moment of inertia and solve problems related to friction**
		CO 3	**Determine reactions of beams, calculate forces in cables using principles of equilibrium**
		CO 4	**Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space**

		CO 5	**Calculate position, velocity and acceleration of particle using principles of kinematics**
		CO 6	**Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy**
101011	**Engineering Mechanics- Lab**	CO 1	**Determine resultant of various force systems**
		CO 2	**Determine centroid, moment of inertia and solve problems related to friction**
		CO 3	**Determine reactions of beams, calculate forces in cables using principles of equilibrium**
		CO 4	**Calculate position, velocity and acceleration of particle using principles of kinematics**
		CO 5	**Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy principle**
101014	**Audit Course-2: Environmental Studies-II**	CO 1	**Have an understanding of environmental pollution and the science behind those problems and potential solutions.**
		CO 2	**Have knowledge of various acts and laws and will**

			be able to identify the industries that are violating these rules.
		CO 3	**Assess the impact of ever increasing human population on the biosphere: social, economic issues and role of humans in conservation of natural resources.**
		CO 4	**Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues.**
Second Year -2019 Course			
Semester I			
201001	**Building Technology and Architectural Planning**	CO 1	Identify types of building and basic requirements of building components
		CO 2	Make use of Architectural Principles and Building byelaws for building construction
		CO 3	Plan effectively various types of Residential Building forms according to their utility, functions with reference to National Building Code..
		CO 4	Plan effectively various types of Public Buildings according to their utility functions with reference to National Building Code.

		CO 5	Make use of Principles of Planning in Town Planning, Different Villages and Safety aspects
		CO 6	Understand different services and safety aspects
201002	**Mechanics of Structures**	CO 1	Understand the concept of stress-strain and determine different types of stress, strain in determinate, indeterminate homogeneous and composite structures..
		CO 2	Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate shear force and bending moment diagram.
		CO 3	Explain the concept of shear and bending stresses in beams and demonstrate shear and bending stress distribution diagram..
		CO 4	Use theory of torsion to determine the stresses in a circular shaft and understand the concept of Principal stresses and strains..
		CO 5	Analyze axially loaded and eccentrically loaded column.
		CO 6	Determine the slopes and deflection of determinate beams and trusses.
201003	**Fluid Mechanics-I**	CO 1	Understand the use of Fluid Properties, concept of Fluid statics, basic equation of Hydrostatics, measurement of fluid pressure, buoyancy & floatation and its application for solving practical problems.

		CO 2	Understand the concept of fluid kinematics with reference to Continuity equation and fluid dynamics with reference to Modified Bernoulli's equation and its application to practical problems of fluid flow
		CO 3	Understand the concept of Dimensional analysis using Buckingham's π theorem, Similarity & Model Laws and boundary layer theory and apply it for solving practical problems of fluid flow
		CO 4	Understand the concept of laminar and turbulent flow and flow through pipes and its application to determine major and minor losses and analyze pipe networks using Hardy Cross method.
		CO 5	Understand the concept of open channel flow, uniform flow and depth-Energy relationships in open channel flow and make use of Chezy's and Manning's formula for uniform flow computation and design of the most economical channel section.
		CO 6	Understand the concept of gradually varied flow in open channel and fluid flow around submerged objects, compute GVF profile and calculate drag and lift force on a fully submerged body.
207001	**Engineering Mathematics III**	CO 1	Solve Higher order linear differential equations and its applications to modelling and analysing Civil engineering problems such as bending of beams, whirling of shafts and mass spring systems.

		CO 2	Solve System of linear equations using direct & iterative numerical techniques and develop solutions for ordinary differential equations using single step & multistep methods applied to hydraulics, geotechnics and structural systems
		CO 3	Apply Statistical methods like correlation, regression and probability theory in data analysis and predictions in civil engineering.
		CO 4	Perform Vector differentiation &integration, analyze the vector fields and apply to fluid flow problems.
		CO 5	Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations.
207003	Engineering Geology	CO 1	Explain about the basic concepts of engineering geology, various rocks, and minerals both in lab and on the fields and their inherent characteristics and their uses in civil engineering constructions.
		CO 2	Exploring the importance of mass wasting processes and various tectonic processes that hampers the design of civil engineering projects and its implications on environment and sustainability.
		CO 3	Recognize effect of plate tectonics, structural geology and their significance and utility in civil engineering activities.
		CO 4	Incorporate the various methods of survey, to evaluate

			and interpret geological nature of the rocks present at the foundations of the dams, percolation tanks, tunnels and to infer site / alignment/ level free from geological defects.
		CO 5	Assess the Importance of geological nature of the site, precautions and treatments to improve the site conditions for dams, reservoirs, and tunnels.
		CO 6	Explain geological hazards and importance of groundwater and uses of common building stones.
201004	**Building Technology and Architectural Planning - Lab**	CO 1	Identify types of building and basic requirements of building components.
		CO 2	Explain types of masonry, formwork, casting procedure and necessity of underpinning and scaffolding.
		CO 3	Elucidate different types of flooring and roofing materials.
		CO 4	Describe types of doors, windows, arches and lintel.
		CO 5	Illuminate means of vertical circulation and protective coatings.
		CO 6	Explain different materials especially eco-friendly materials and safety measures to be adopted at any construction site.

201005	**Mechanics of Structures - Lab**	CO 1	to determine the mechanical properties of metal in tension ,shear torsion and impact
		CO 2	to know the properties of timber in compression and bending
		CO 3	to know the properties of bricks
		CO 4	to know the properties of tiles in flexural and abrasion
201006	**Fluid Mechanics-I-Lab**	CO 1	Use fluid properties, dimensional analysis for solving problems of fluid flow.
		CO 2	Solve fluid statics problems
		CO 3	Measure fluid pressure.
		CO 4	Calibrate discharge measuring instrument like venturi-meter, orifice meter
		CO 5	Design pipes to carry particular amount of discharge
		CO 6	Use fluid properties, dimensional analysis for solving problems of fluid flow.
207004	Engineering Geology - Lab	CO 1	Explain basic concepts, common rocks, minerals, their significance and application in civil engineering.

		CO 2	Recognize tectonic effects, Geological structures and their significance in Civil Engineering.
		CO 3	Recall geomorphology, stratigraphy and physiographic divisions of India.
		CO 4	Incorporate findings of Geological investigation, remote sensing and GIS techniques in civil engineering.
		CO 5	Infer Geological conditions, nature of rocks, and site suitability for construction of building, road, dam, tunnel and treatment to unfavourable rocks masses
		CO 6	Explain geological hazards, geo-hydrological characters of the rocks, mass wasting processes, and good building stones.
201009	**Surveying**	CO 1	Define and Explain basics of plane surveying and differentiate the instruments used for it**.**
		CO 2	Express proficiency in handling surveying equipment and analyse the surveying data from these equipment.
		CO 3	Describe different methods of surveying and find relative positions of points on the surface of earth.
		CO 4	Execute curve setting for civil engineering projects such as roads, railways etc.
		CO5	Articulate advancements in surveying such as space

			based positioning systems
		CO6	Differentiate map and aerial photographs, also interpret aerial photographs
	Audit Course: Awareness to Civil Engineering Practices	CO 1	Study different types of civil engineering industries and their functioning.
		CO 2	Applications of different documents, drawings, regulations in Civil Engineering industries.
		CO 3	Code of ethics to be practiced by a Civil Engineer and understand duties and responsibilities as a Civil Engineer
		CO 4	Student will able to find different safety practices on the site.
201008	Geotechnical Engineering	CO 1	Identify and classify the soil based on the index properties and its formation process
		CO 2	Explain permeability and seepage analysis of soil by construction of flow net.
		CO 3	Illustrate the effect of compaction on soil and understand the basics of stress distribution.
		CO 4	Express shear strength of soil and its measurement under various drainage conditions.

		CO5	Evaluate the earth pressure due to backfill on retaining structures by using different theories.
		CO6	Analysis of stability of slopes for different types of soils
201009	Surveying	CO 1	Define and Explain basics of plane surveying and differentiate the instruments used for it.
		CO 2	Express proficiency in handling surveying equipment and analyse the surveying data from these equipment.
		CO 3	Describe different methods of surveying and find relative positions of points on the surface of earth.
		CO 4	Execute curve setting for civil engineering projects such as roads, railways etc.
		CO5	Articulate advancements in surveying such as space based positioning systems
		CO6	Differentiate map and aerial photographs, also interpret aerial photographs
201010	Concrete Technology	CO 1	Able to select the various ingredients of concrete and its suitable proportion to achieved desired strength.
		CO 2	Able to check the properties of concrete in fresh and hardened state.

		CO 3	Get acquainted to concreting equipments, techniques and different types of special concrete.
		CO 4	Able to predict deteriorations in concrete and get acquainted to various repairing methods and techniques
201011	Structural Analysis	CO 1	Understand the basic concept of static and kinematic indeterminacy and analysis of indeterminate beams.
		CO 2	Analyze redundant trusses and able to perform approximate analysis of multi-story multi-bay frames.
		CO 3	Implement application of the slope deflection method to beams and portal frames.
		CO 4	Analyze beams and portal frames using moment distribution method.
		CO5	Determine response of beams and portal frames using structure approach of stiffness matrix method.
		CO6	Apply the concepts of plastic analysis in the analysis of steel structures.
201012	Project Management	CO 1	Describe project life cycle and the domains of Project Management.

		CO 2	Explain networking methods and their applications in planning and management
		CO 3	Categorize the materials as per their annual usage and also Calculate production rate of construction equipment
		CO 4	Demonstrates resource allocation techniques and apply it for manpower planning.
		CO5	Understand economical terms and different laws associated with project management
		CO6	Apply the methods of project selection and recommend the best economical project.
201003	**Geotechnical Engineering- Lab**	CO 1	Differentiate the different types of soil and their engineering properties and classify
		CO 2	Determine the soil properties in laboratory and develop a proficiency in handling
		CO 3	Develop an understanding of the influence of water flow on the engineering
		CO 4	Analyze engineering properties like compaction, permeability, soil shear strength.

201014	Surveying - Lab	CO 1	Operate and use surveying equipment.
		CO 2	Draw plan or map of the existing permanent features on the ground
		CO 3	Classify the ground features from the map or plan
		CO 4	Analyze temporary adjustments and check permanent adjustments of the Theodolite.
201015	**Concrete Technology - Lab**	CO 1	Understand chemistry, properties, and classification of cement, fly ash, aggregates and admixtures, and hydration of cement in concrete.
		CO 2	Prepare and test the fresh concrete
		CO 3	Test hardened concrete with destructive and non-destructive testing instruments
		CO 4	Design concrete mix of desired grade
201017	Project Based Learning	CO 1	Identify the community/ practical/ societal needs and convert the idea into a product/ process/ service.
		CO 2	Analyse and design the physical/ mathematical/ ICT model in order to solve identified problem/project.

		CO 3	Create, work in a team and applying the solution in practical way to specific problem.
Third Year			
Semester I			
301001	**Hydrology and Water Resource Engineering**	CO 1	Understand government organizations, apply & analyze precipitation & its abstractions
		CO 2	Understand, apply & analyze runoff, runoff hydrographs and gauging of streams
		CO 3	Understand, apply & analyze floods, hydrologic routing & Q-GIS software in hydrology.
		CO 4	Understand, apply & analyze reservoir planning, capacity of reservoir & reservoir economics.
		CO 5	Understand water logging & water management, apply & analyze ground water hydrology
		CO 6	Understand irrigation, piped distribution network and canal revenue, apply and analyze crop water requirement
301002	**Water Supply Engineering**	CO1	Define identify, describe reliability of water sources, estimate water requirement for various sectors

		CO 2	Ascertain and interpret water treatment method required to be adopted with respect to source and raw water characteristics
		CO 3	Design various components of water treatment plant and distribution system.
		CO 4	Understand and compare contemporary issues and advanced treatment operations and process available in the market, including packaged water treatment plants.
		CO 5	Design elevated service reservoir capacity and understand the rainwater harvesting.
		CO 6	Understand the requirement of water treatment plant for infrastructure and Government scheme.
301003	**Design of Steel Structures**	CO 1	Demonstrate knowledge about the types of steel structures, steel code provisions and design of the adequate steel section subjected to tensile force.
		CO 2	Determine the adequate steel section subjected to compression load and design of built up columns along with lacing and battening.
		CO 3	Design eccentrically loaded column for section strength and column bases for axial load and uniaxial bending

		CO 4	Design of laterally restrained and unrestrained beam with and without flange plate using rolled steel section.
		CO 5	Analyze the industrial truss for dead, live and wind load and design of gantry girder for moving load.
		CO 6	Understand the role of components of welded plate girder and design cross section for welded plate girder including stiffeners and its connections
301004	**Engineering Economics and Financial Management**	CO 1	Understand basics of construction economics
		CO 2	Develop an understanding of financial management in civil engineering projects
		CO 3	Prepare and analyze the contract account
		CO 4	Decide on right source of fund for construction projects
		CO 5	Understand working capital and its estimation for civil engineering projects
		CO 6	Illustrate the importance of tax planning & understand role of financial regulatory bodies
301005	**Advanced Concrete**	CO 1	Understand the chemistry of cement and its effect on

	Technology		properties of concrete
		CO 2	Apply the knowledge of supplementary cementitious materials to produce sustainable concretes
		CO 3	Understand the mechanism of working of admixtures and their effect on properties of concrete
		CO 4	Evaluate the characteristic properties of fiber reinforced concrete
		CO 5	Understand the durability properties of concrete
		CO 6	Interpret the properties of concrete through advance testing methods
301006	**Seminar**	CO 1	Appraise the current civil engineering research / techniques / developments / interdisciplinary areas
		CO 2	Review and organize literature survey utilizing technical resources, journals etc.
		CO 3	Evaluate and draw conclusions related to technical content studied.
		CO 4	Demonstrate the ability to perform critical writing by preparing a technical report.

		CO 5	Develop technical writing and presentation skills.
301007	**Hydrology and Water Resource Engineering Lab**	CO 1	To impart knowledge of precipitation and abstractions in precipitation
		CO 2	To impart knowledge of rainfall-runoff relationship and flood using hydrograph theory and to solve problems related to runoff and flood discharge.
		CO 3	To introduce students the concept of Reservoir planning and yield of reservoir.
		CO 4	Study software applications in water resources engineering
301008	**Water Supply Engineering Lab**	CO 1	Engineers with the ability to analyze pH and alkalinity and hardness of drinking water
		CO 2	Engineers having the ability analyze chlorine demand and residual chlorine.
		CO 3	Engineers with the ability to analyze the water quality such as turbidity
		CO 4	Engineers having ability to find out iron content and fluoride content present in row water
		CO 5	Engineers with the ability to analyse ecoil bacteria present in drinking water/ row water

		CO 6	Engineers Understand various components of water supply scheme and how to design water distribution system
301009	**Design of Steel Structures Lab**	CO 1	Ability to understand concepts of connections and tension members, compression members.
		CO 2	Able to understand the concepts of built up sections, beams and girders.
		CO 3	Ability to do the analysis of roof truss
		CO 4	Ability to decide sections of roof truss
		CO 5	To understand the concept of welded plate girder for application.
301010	**Advanced Concrete Technoylog Lab**	CO 1	To determine the drying shrinkage of cement/concrete in accordance to IS 1199
		CO 2	To determine the permeability of concrete in accordance to IS 3085
		CO 3	To determine the improvement in toughness of concrete containing fibers
		CO 4	To determine the optimum dosage of plasticizers and

			super plasticizers for different types of cement
		CO 5	To determine the chloride content in hardened mortar / concrete in accordance to IS: 14959 (Part 2)
		CO 6	To determine the elastic modulus of concrete in accordance to IS: 516 and perform Ultrasonic pulse Velocity Method NDT
301011b	**Audit Course I: Sustainable Energy Systems**	CO 1	To demonstrate an overview of the main sources of renewable energy
		CO 2	To understand benefits of renewable and sustainable energy systems
Semester II			
301012	**Waste Water Engineering**	CO 1	Recall sanitation infrastructure, quantification and characterization of wastewater, natural purification of streams
		CO 2	Design preliminary and primary unit operations in waste water treatment plant
		CO 3	Understand theory and mechanism of aerobic biological treatment system and to design activated sludge process

		CO 4	Understand and design suspended and attached growth wastewater treatment systems
		CO 5	Explain and apply concept of contaminant removal by anaerobic, tertiary and emerging wastewater treatment systems
		CO 6	Compare various sludge management systems and explain the potential of recycle and reuse of wastewater treatment
301013	**Design of Reinforced Concrete Structures**	CO 1	Apply relevant IS provisions to ensure safety and serviceability of structures, understand the design philosophies and behavior of materials: steel & concrete
		CO 2	Recognize mode of failure as per LSM and evaluate moment of resistance for singly, doubly rectangular, and flanged sections
		CO 3	Design & detailing of rectangular one way and two-way slab with different boundary conditions
		CO 4	Design & detailing of dog legged and open well staircase
		CO 5	Design & detailing of singly/doubly rectangular/flanged beams for flexure, shear, bond and torsion.

		CO 6	Design & detailing of short columns subjected to axial load, uni-axial/bi-axial bending and their footings
301014	**Remote Sensing and Geographic Information System**	CO 1	Articulate fundamentals and principles of RS techniques
		CO 2	Demonstrate the knowledge of remote sensing and sensor characteristics
		CO 3	Distinguish working of various spaces-based positioning systems.
		CO 4	Analyze the RS data and image processing to utilize in civil engineering
		CO 5	Explain fundamentals and applications of RS and GIS
		CO 6	Acquire skills of data processing and its applications using GIS
301015a	**Advanced Engineering Geology with Rock Mechanics**	CO 1	Illustrate seismic zones, plate tectonics and civil engineering significance of major rock formations of India with their characteristics
		CO 2	Explain soil profile, geo-hydrological characters of various rock formations and necessity of geological studies in water conservation

		CO 3	Apply knowledge of geology in Infrastructural, Urban development and demonstrate importance of national wealth
		CO 4	Validate the suitability of rocks based on mechanical properties, R.Q.D. and geophysical exploration.
		CO 5	Explore subsurface Geology for civil engineering projects to suggest foundation treatments for various geological defects and channel erosion
		CO 6	Illustrate the suitability of proposed alignments for tunnels and bridges on the basis of Geological investigations
301015e	**Architecture and Town Planning**	CO 1	Apply the principles of architectural planning and landscaping for improving quality of life
		CO 2	Understand the confronting issues of the area and apply the acts.
		CO 3	Evaluate and defend the proposals
		CO 4	Appraise the existing condition and to develop the area for betterment

301016	**Internship**	CO 1	To develop professional competence through industry internship
		CO 2	To apply academic knowledge in a personal and professional environment
		CO 3	To build the professional network and expose students to future employees
		CO 4	Apply professional and societal ethics in their day to day life
		CO5	To become a responsible professional having social, economic and administrative considerations
		CO6	To make own career goals and personal aspirations
301017	**Waste Water Engineering Lab**	CO1	Student can determine dissolved oxygen present in a given wastewater sample
		CO2	Student learn how to determine the Bio-Chemical Oxygen Demand in a given wastewater sample
		CO3	Understand how to find out the total solids, present in the wastewater
		CO4	Learn about how to find out Sludge Volume Index ,

			Electrical Conductivity in a given wastewater sample
		CO5	Learn about how to find out Phosphates and Nitrates by spectrophotometer in a given wastewater sample
		CO6	Understand computer aided design of Sewage Treatment Plant (STP) OR Effluent Treatment Plant
301018	**Design of Reinforced Concrete Structures Lab**	CO 1	Draw G+2 building covering all structural elements
		CO 2	Design and analyze all slabs and beams of typical floor
		CO 3	Design and analyze the columns
		CO 4	Design and analyze the footings.
		CO 5	Draw a structural plan by using drafting software.
		CO 6	understand the steel detailing of structural elements of under construction building through a study tour
301019	**Remote Sensing and Geographic Information System Lab**	01	Articulate fundamentals and principles of RS techniques.
		02	Demonstrate the knowledge of remote sensing and sensor characteristics.

		03	Distinguish working of various spaces-based positioning systems.
		04	Analyze the RS data and image processing to utilize in civil engineering
		05	Explain fundamentals and applications of RS and GIS
		06	Acquire skills of data processing and its applications using GIS
301020a	**Advanced Engineering Geology with Rock Mechanics Lab**	CO 1	Explain distribution, Geological characters and Civil Engineering significance of major rock formations of India.
		CO 2	Explain geohydrological characters, morphometric analysis, geological aspects of water conservation and process of soil formation.
		CO 3	Apply geological knowledge in planning, development and resource engineering.
		CO 4	Validate the suitability of rocks on the basis of physical and mechanical properties, R.Q.D. and geophysical investigation
		CO 5	Explore subsurface Geology for various Civil Engineering projects, foundation, treatments and tail channel.

		CO 6	Illustrate the suitability of various rock fields for tunneling and bridge.
301020e	**Architecture and Town Planning Lab**	CO 1	Students will be able to understand and analyze Development Plan with respect to different parameters.
		CO 2	Students will be able to make constructive use of neighbor-hood planning in city and township development
		CO 3	Students will be able to learn various schemes related to town planning that in-turn will be helpful in designing and developing a town.
		CO 4	Students will get the knowledge of different special zones that helps in developing the town and city.
		CO 5	Students will acquire the knowledge regarding various acts and amendments in regards to town planning.
		CO 6	Students will be able to make use of techniques like remote sensing and GPS in town planning effectively.
301021 b	**Industrial Safety**	CO 1	Analyze the safety problem with its solution
Fourth Year			
Semester I			
401001	**Foundation Engineering**	CO 1	Perform subsurface investigations for foundations using different methods

		CO 2	Estimate the bearing capacity of shallow foundations.
		CO 3	Calculate immediate and primary consolidation settlement of shallow foundations
		CO 4	Decide the capacity of a pile and pile group
		CO 5	Understand the steps in geotechnical design of shallow foundations and well foundations.
		CO 6	Analyze problems related to expansive soil and overcome them using design principles, construction techniques in black cotton soil.
401002	**Transportation Engineering**	CO 1	Understand principles and practices of transportation planning.
		CO 2	Demonstrate knowledge of traffic studies, analysis and their interpretation.
		CO 3	Design Geometric Elements of road pavement.
		CO 4	Evaluate properties of highway materials as a part of road pavement.
		CO 5	Appraise different types of pavements and their design.
		CO 6	Understand the fundamentals of Bridge Engineering and Railway Engineering
401 003 b	**Elective III: Advanced Design of Concrete**	CO 1	Understand yield line theory and apply it to analyze and design slabs of different shapes having different edge

	Structures		conditions
		CO 2	Understand the concepts of ductile detailing
		CO 3	Analyze and design of flat slab.
		CO 4	Analyze and design of retaining walls.
		CO 5	Analyze and design of liquid retaining structures.
		CO 6	Analyze and design of RC frames and shear walls.
401 004 a	**Elective IV: Air Pollution and Control**	CO 1	Recall air pollution, legislation and regulations.
		CO 2	Evaluate air pollutant concentrations as a function of meteorology.
		CO 3	Interpret sampling results with prescribed standards
		CO 4	Assess emission inventory and air quality models
		CO 5	Compare the air pollution control equipments.
		CO 6	Infer indoor air pollution and its mitigation.

401005	**Project Stage I**	CO 1	Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas
		CO 2	Review and organize literature survey utilizing technical resources, journals etc.
		CO 3	Evaluate and draw conclusions related to technical content studied.
		CO 4	Demonstrate the ability to perform critical writing by preparing a technical report.
		CO 5	Develop technical writing and presentation skills.
401006	**Transportation Engineering Lab**	CO 1	Evaluate properties of aggregates such as toughness, strength, hardness, shapes, water absorption, specific gravity etc. as a part of road pavement.
		CO 2	Evaluate properties of bitumen materials such as consistency, ductility, flash and fire, specific gravity etc. as a part of road pavement.
		CO 3	Evaluate properties of combined aggregates and bitumen materials as a part of road pavement.
		CO 4	Evaluate properties of highway surface and subgrade materials as a part of road pavement through technical visit.
401 007 b	**Elective III: Advanced Design of Concrete Structures Lab**	CO 1	Understand yield line theory and apply it to analyze and design slabs of different shapes having different edge conditions.

		CO 2	Understand the concepts of ductile detailing
		CO 3	Analyze and design of flat slab.
		CO 4	Analyze and design of retaining walls.
		CO 5	Analyze and design of liquid retaining structures.
		CO 6	Analyze and design of RC frames and shear walls.
401 008 a	**Elective IV: Air Pollution and Control Lab**	CO 1	Students can analyze the PM 10, and PM 2.5
		CO 2	Students can analyze the SO2 and NO2
		CO 3	Students can understand the Air Quality index
		CO 4	Students are able to know the quality of air in the industrial area.
401 009	**Computer Programming in Civil Engineering**	CO1	Understand basics of Python Programming
		CO2	Write Python codes for variety of problems in civil Engineering
401010	**Audit Course I a: Stress Management by Yoga**	CO 1	Develop understanding of Yoga and its impact on human body and mind.

		CO 2	Learn different Yogasans
		CO 3	Develop an understanding of meditation through pranayama
		CO 4	Learn different techniques of Pranayam
Semester II			
401011	**Dams and Hydraulics Structures**	CO 1	Understand types of dams and instrumentation working
		CO 2	Execute stability analysis of Gravity Dam
		CO 3	Understand types of spillways & Design of Ogee spillway
		CO 4	Illustrate the failures and analyze stability of earthen dam
		CO 5	Design Canals and understand the canal structures
		CO 6	Analysis of the Diversion headwork and Cross Drainage work
401012	**Quantity Surveying, Contracts and Tenders**	CO 1	Understand concept of estimates and prepare approximate estimate for various for Civil Engineering works.
		CO 2	Describe tendering process, construction contracts, and aspects of Arbitration and prepare tender documents.
		CO 3	Prepare detailed estimate of various items of work by different methods and calculate quantity of steel from Bar

			bending schedule.
		CO 4	Apply engineering knowledge to prepare estimate for roads, culverts, and water tank
		CO 5	Apply concepts of specification to draft brief specification, detailed specification and prepare detailed rate analysis report.
		CO 6	Evaluate depreciation and valuation of property on the basis of present condition, specifications and market trend.
401013 e	**Elective V: Hydropower Engineering**	CO 1	Understand the classification of power resources & trends in energy use patterns.
		CO 2	Identify the components of hydro power plant
		CO 3	Analyze the load assessment for turbines
		CO 4	Prepare the layout of power house based on the various structures need for it.
		CO 5	Design the turbines and surge tanks.
		CO 6	Understand the laws and regulatory aspects of hydroelectric power.
401014 a	**Elective VI: TQM and MIS**	CO 1	Recognize quality and contribution of quality gurus for evaluation of best practices

		CO 2	Relate the functioning and application of TQM & Six Sigma in the domain of construction sector
		CO 3	Recommend ISO 9001 principles in preparation of quality manual to construction business
		CO 4	Apply management control & certification systems for construction industry
		CO 5	Choose TQM process implementation and various quality awards for construction sector
		CO 6	Propose MIS for allied fields in construction sector
401 015	**Project Stage II**	CO 1	Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas
		CO 2	Review and organize literature survey utilizing technical resources, journals etc.
		CO 3	Evaluate and draw conclusions related to technical content studied.
		CO 4	Demonstrate the ability to perform critical writing by preparing a technical report.
		CO 5	Develop technical writing and presentation skills.
401016	**Dams and Hydraulics Structures Lab**	CO 1	Students can understand Dam, its Safety and Behavioral aspects of Dam with Instruments.
		CO 2	Students can analyze and designed Gravity Dam, Earthen Dam with different stability condition.

		CO 3	Student can understand concept of the Spillway, Gates and layout of Hydropower plant.
		CO 4	Students are gained the knowledge in failure aspects of Earthen Dam and Design of Diversion Head Works.
		CO 5	Students are able to design canal and canal structures.
		CO 6	Students are understood C. D. Work and River Training Works.
401 017	**Quantity Surveying, Contracts and Tenders Lab**	CO 1	Student should understand the types of estimates and its pre-requisites
		CO 2	Students will be able to calculate the estimates and bar bending schedule
		CO 3	Students will be able to determine rates of various items and learn specifications
		CO 4	Students will be able to understand valuation and methods of valuation
		CO 5	Students will be able to understand about tenders and methods of work execution
		CO 6	Students will be able to understand about contracts and arbitration
401 018 e	Elective V:**Hydropower Engineering Lab**	CO 1	Students can understand and identify various types of hydropower plant and their components

		CO 2	Students will be able to understand and do the load assessment of power plant
		CO 3	Students will gain the knowledge of water conductor system and power house
		CO 4	Students will be able to describe the working principles of different types of turbine and understand the phenomenon associated with it.
		CO 5	Students will gain the knowledge of economics of Hudropower plants as well as laws and regulatory aspects of electricity.
401019	Audit Course II a: Social Responsibility	CO1	Develop understanding of social responsibility
		CO2	Learn the International framework for Social Responsibility
		CO3	Know the drivers of social responsibility in India
		CO4	Identify the key stakeholders of social responsibility