

Shree Mahavir Education Society's  
Sanghavi College of Engineering, Nashik

**Department of Civil Engineering**

**Course Outcomes**

**Final Year (2019 Pattern) : Semester-I**

Course code	Course Name	Course Outcomes(Cos)
401001	Foundation Engineering	CO1. Perform subsurface investigations for foundations using different methods. CO2. Estimate the bearing capacity of shallow foundations. CO3. Calculate immediate and primary consolidation settlement of shallow foundations. CO4. Decide the capacity of a pile and pile group. CO5. Understand the steps in geotechnical design of shallow foundations and well foundations. CO6. Analyze problems related to expansive soil and overcome them using design principles, construction techniques in black cotton soil.
401002	Transportation Engineering	CO1. Understand principles and practices of transportation planning. CO2. Demonstrate knowledge of traffic studies, analysis and their interpretation. CO3. Design Geometric Elements of road pavement. CO4. Evaluate properties of highway materials as a part of road pavement. CO5. Appraise different types of pavements and their design. CO6. Understand the fundamentals of Bridge Engineering and Railway Engineering
401003 a	Elective III: Coastal Engineering	CO1. Understand basic of ocean waves including wave generation, classification, propagation, wave theories, wave diffraction, wave reflection and wave breaking. CO2. Understand and apply short term and long-term wave analysis. CO3. Understand basic characteristics of tides, tide producing forces, dynamic theory of tides. CO4. Understand coastal process of erosion/accretion due to waves, bed forms, long shore transport (Littoral drift) and estimation of wave induced sediment quantity. CO5. Understand the coastal structures and shore protection methods. CO6. Understand coastal zone management activities, issues related to integrated coastal zone management and regulation of coastal zone.

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401003 b	Elective III: Advanced Design of Concrete Structures	<p>CO1: Understand yield line theory and apply it to analyze and design slabs of different shapes having different edge conditions.</p> <p>CO2: Understand the concepts of ductile detailing</p> <p>CO3: Analyze and design of flat slab.</p> <p>CO4: Analyze and design of retaining walls.</p> <p>CO5: Analyze and design of liquid retaining structures.</p> <p>CO6: Analyze and design of RC frames and shear walls</p>
401003 c	Elective III: Integrated Water Resources Planning and Management	<p>CO1: Understand concerned organizations, IWRP &amp; M objectives, principles, challenges, application &amp; analysis of IWRP&amp;M approaches &amp; principles in a case study.</p> <p>CO2: Understand PIM, WDS, WALMI, agriculture in the concept of integrated water resources, apply and analyse water requirements for food production</p> <p>CO3: Understand assessment of surface and ground water quality, EIA, CPCB regulations, application &amp; analysis of effluent quality standards as per CPCB</p> <p>CO4: Understand water economics and funding, application &amp; analysis of planning for a sustainable water future</p> <p>CO5: Understand legal regulatory settings of IWRP &amp; M, application &amp; analysis of inter-basin water transfers and IWRP &amp; M</p> <p>CO6: Understand flood control &amp; power generation for IWRP &amp; M, application QIGIS for analysis of a basin for IWRP &amp; M</p>
401003 d	Elective III: Finite Element Method	<p>CO1: To understand the basics of solid mechanics prior to learn finite element analysis.</p> <p>CO2: Solve simple Engineering problems using 1D, 2D and 3D elements</p> <p>CO3: Write shape functions of 1D, 2D and 3D elements</p> <p>CO4: Determine the stresses in three dimensional finite elements using isoparametric formulation.</p> <p>CO5: Analyze the truss and beam elements using stiffness matrix and finite element procedure.</p> <p>CO6: Evaluate the forces and stresses in rigid jointed portal frame and grid elements using stiffness matrix and finite element procedure.</p>
401003 e	Elective III: Data Analytics	<p>CO1: Understand the basic concepts of Statistics and its analysis and applications</p> <p>CO2: Solve the problems related to probability and various probability distributions.</p>

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401003 e	Elective III: Data Analytics	CO3: Apply the concept of sampling and distribution and interpret problems using correlation CO4: Analyze and test of hypothesis CO5: Examine and prepare the data and use develop regression CO6: Understand and Apply machine learning algorithms for Regression, Classification and Clustering
401003 f	Elective III: Operation Research	CO1: correlate applications of Operations Research in Civil Engineering field CO2: Solve the problems related to stochastic programming CO3: Optimize transportation and assignment problems CO4: Optimize linear problems CO5: Optimize non-linear problems CO6: Suggest solution for the problems related to dynamic models, games theory and replacement of items
401004 a	Elective IV: Air Pollution and Control	CO1: Recall air pollution, legislation and regulations. CO2: Evaluate air pollutant concentrations as a function of meteorology. CO3: Interpret sampling results with prescribed standards. CO4: Assess emission inventory and air quality models. CO5: Compare the air pollution control equipments. CO6: Infer indoor air pollution and its mitigation.
401004 b	Elective IV: Advanced Design of Steel Structures	CO1: Understand the behavior and design of members subjected to combined forces CO2: Design moment resisting connection CO3: Design component / structure using cold form light gauge section CO4: Design members of truss and scaffolding using tubular section CO5: Design castellated beam CO6: Analyze and design components of industrial structure such as Portal frame and gable frame
401004 c	Elective IV: Statistical Analysis and Computational Methods	CO1: Understand the basic concepts of Statistics and perform statistical data analysis CO2: Understand the concept of probability and fit Binomial, or Poisson or Normal distribution to the given data CO3: Understand concept of sampling and perform chi-square test, z test, Student T test CO4: Perform hypothesis test CO5: Carry out correlation and regression analysis for the given data CO6: Calculate variance and perform K-S test for goodness of fit

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401004 d	Elective IV: Airport and Bridge Engineering	CO1. Understand the fundamental of airport. CO2. Understand and design the runway and taxiway and drainage systems. CO3. Understand the BIM, AR and VR in airport planning and pavement design. CO4. Plan the lighting and marking of airport and heliport. CO5. Estimate various components of bridge and loads on bridges. CO6. Study and design of bridge structures.
401004 e	Elective IV: Design of Prestressed Concrete Structures	CO1: Know the prestressed members. CO2: Determining the stresses and various losses in prestressed concrete members. CO3: Design the prestressed concrete structures CO4: Design the prestressed concrete slab CO5: Design the prestressed concrete flat slab CO6: Analysis and design the prestressed continuous beams
401004 f	Elective IV: Formwork and Plumbing Engineering	CO1: Select appropriate material and type of formwork CO2: Analyze the formwork for various loadings. CO3: Illustrate the design aspects of formwork under various requirements. CO4: Understand requirement of plumbing in a building. CO5: Understand plumbing hydraulics and its components in plumbing system. CO6: Illustrate the design aspects as per the requirement of Indian Standards.
401005	Project Stage I	CO1. Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas. CO2. Review and organize literature survey utilizing technical resources, journals etc. CO3. Evaluate and draw conclusions related to technical content studied. CO4. Demonstrate the ability to perform critical writing by preparing a technical report. CO5. Develop technical writing and presentation skills.
401009	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	CO1. Develop understanding of Yoga and its impact on human body and mind. CO2. Learn different Yogasans CO3. Develop an understanding of meditation through pranayama CO4. Learn different techniques of Pranayam

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401010	Audit Course I b: Communication Etiquette in Workplaces	CO1. Develop an understanding of workplace codes, professionalism at workplace CO2. Learn the workplace ethics CO3. Develop an understanding of Business ethics, workplace privacy and ethics CO4. Learn teamwork at workplace
<b>Final Year (2019 Pattern) : Semester-II</b>		
401011	Dams and Hydraulics Structures	CO1. Understand types of dams and instrumentation working CO2. Execute stability analysis of Gravity Dam CO3. Understand types of spillways & Design of Ogee spillway CO4. Illustrate the failures and analyze stability of earthen dam CO5. Design Canals and understand the canal structures CO6. Analysis of the Diversion headwork and Cross Drainage work
401012	Quantity Surveying, Contracts and Tenders	CO1. Understand concept of estimates and prepare approximate estimate for various for Civil Engineering works. CO2. Describe tendering process, construction contracts, and aspects of Arbitration and prepare tender documents. CO3. Prepare detailed estimate of various items of work by different methods and calculate quantity of steel from Bar bending schedule. CO4. Apply engineering knowledge to prepare estimate for roads, culverts, and water tank (Elevated storage tank) CO5. Apply concepts of specification to draft brief specification, detailed specification and prepare detailed rate analysis report. CO6. Evaluate depreciation and valuation of property on the basis of present condition, specifications and market trend.
401013 a	Elective V: Earthquake Engineering	CO1: Define the concepts of earthquakes, seismology and vibrations. CO2: Model physical structures and develop equations of motion. CO3: Solve the equations of motion for SDOF systems. CO4: Solve the equations of motion for MDOF systems. CO5: Perform static seismic analysis for buildings. CO6: Perform dynamic seismic analysis for buildings.
401013 b	Elective V: Structural Design of Bridges	CO1: Identify loads on bridges and selection of type of bridge for the site condition as per Indian standards. CO2: Design the reinforced concrete deck slab, culvert slab and T beam deck slab for highway bridges. CO3: Analysis and design of reinforced concrete and post tension prestressed concrete girders. CO4: Classify the types of rail bridges and design the plate girder

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401013 b	Elective V: Structural Design of Bridges	steel bridges CO5: Analyse and design the steel trussed bridges. CO6: Study different types of bearing and thereby design the bearings for reinforced concrete highway bridges.
401013 c	Elective V: Irrigation and Drainage	CO1: Summarize types of irrigation methods. CO2: Estimate evapotranspiration and crop-water requirement. CO3: Understand component parts and their design considerations of lift irrigation system. CO4: Design drip and sprinkler irrigation systems. CO5: Understand basics of salt affected soils and estimate leaching requirement. CO6: Design surface and subsurface drainage systems.
401013 d	Elective V: Design of Precast and Composite Structures	CO1: Achieve knowledge of design and development of problem solving skills. CO2: Explore the concept of precast construction. CO3: Learn the principles and design of precast structures CO4: Understand the need, advantages and limitations of composite material. CO5: Apply basic mechanical principles in analysis of composite structures like beams, columns, floors, shear connectors. CO6: Understand and apply various provisions as per Indian standards in design of structural components using composite materials
401013 e	Elective V: Hydropower Engineering	CO1. Understand the classification of power resources & trends in energy use patterns. CO2. Identify the components of hydro power plant. CO3. Analyze the load assessment for turbines. CO4. Prepare the layout of power house based on the various structures need for it. CO5. Design the turbines and surge tanks. CO6. Understand the laws and regulatory aspects of hydroelectric power.
401013 f	Elective V: Structural Audit and Retrofitting of Structures	CO1: Identify causes of deterioration in RC and steel structures. CO2: Explore entire process of structural audit. CO3: Explore necessity and methods of structural health monitoring. CO4: Explain method of retrofitting for RC, steel and historical structures. CO5: Design retrofitting using FRP for RC column. CO6: Design retrofitting using FRP for RC beams.

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401014 a	Elective VI: TQM and MIS	CO1. Recognize quality and contribution of quality gurus for evaluation of best practices CO2. Relate the functioning and application of TQM & Six Sigma in the domain of construction sector CO3. Recommend ISO 9001 principles in preparation of quality manual to construction business CO4. Apply management control & certification systems for construction industry CO5. Choose TQM process implementation and various quality awards for construction sector CO6. Propose MIS for allied fields in construction sector
401014 b	Elective VI: Advanced Transportation Engineering	CO1: Analyze travel demand model and forecasting. CO2: Evaluate relative importance of various modes and their capacities. CO3: Design facilities required for non-motorized transportation and pedestrians. CO4: Estimate basic characteristics of traffic stream and signal design. CO5: Design flexible pavements. CO6: Design rigid pavements and overlays.
401014 c	Elective VI: Geo-Synthetic Engineering	CO1: Explain types of Geo-synthetic material and its application in construction industry CO2: Define physical and engineering properties of geo-synthetics material CO3: Describe function of geo-synthetics material and its application in geo environment engineering CO4: Analyse effect of geo-synthetics in design of flexible pavements CO5: Design the reinforced soil retaining structures CO6: Explain mechanism of soil reinforcement to improve bearing capacity of soil
401014 d	Elective VI: Structural Design of Foundations	CO1: Judge suitable type of shallow foundation based on the available soil category. CO2: Decide suitable type of pile foundation for different soil stratum and evaluation of group capacity by formulation. CO3: Design Raft foundations. CO4: Design well and caissons Foundations. CO5: Design different types of Machine foundations. CO6: Design Retaining Structures.

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401014 e	Elective VI: Green Structures and Smart Cities	<p>CO1: Students should be able to describe the importance of energy and minimization by altering the building materials.</p> <p>CO2: Students should be able to understand the importance green construction and green rating system</p> <p>CO3: Students should be able to introduce the applications of energy conservation and efficiency practices in buildings.</p> <p>CO4: Students should be able to understand phases and approval involved in smart city project.</p> <p>CO5: Students should be able to assess the national and global experience of smart cities.</p> <p>CO6: Students should be able to understand the importance of sustainable development and current Protocol of sustainable development goals.</p>
401014 f	Elective VI: Rural Water Supply Engineering	<p>CO1: Understand issues related to rural water supply with respect to source, water related issues in rural areas.</p> <p>CO2: Understand role of various government departments and importance of participatory approach.</p> <p>CO3: Understand various types of rural water supply scheme and infrastructure requirements therein</p> <p>CO4: Understand interdisciplinary requirements in RWS including Software</p> <p>CO5: Understand Automation requirements for a Water Supply Project</p> <p>CO6: Understand Documentation and O and M issues related Water Supply Project including Leak Detection.</p>
401015	Project Stage II	<p>CO1. Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas.</p> <p>CO2. Review and organize literature survey utilizing technical resources, journals etc.</p> <p>CO3. Evaluate and draw conclusions related to technical content studied.</p> <p>CO4. Demonstrate the ability to perform critical writing by preparing a technical report.</p> <p>CO5. Develop technical writing and presentation skills.</p>
401019	Audit Course II a: Social Responsibility	<p>CO1. Develop understanding of social responsibility</p> <p>CO2. Learn the International framework for Social Responsibility</p> <p>CO3. Know the drivers of social responsibility in India</p> <p>CO4. Identify the key stakeholders of social responsibility</p>
401019	Audit Course II b: Human Rights	<p>CO1. Gather Knowledge about Human rights and Human rights Movement</p> <p>CO2. Develop understanding of Human rights and Indian Constitution</p> <p>CO3. Discuss Human Rights of the Different Sections and</p>



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401019	Audit Course II b: Human Rights	contemporary issues CO4. Discuss International scenario towards human rights with reference to engineering Industry