CURRICULUM & SYLLABI

B.Tech. MINOR IN CIVIL ENGINEERING

Effective from AY: 2024-25



NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL

WARANGAL, TELANGANA

Scheme for Minor in Civil Engineering:

Code	Course Title	L-T-P	Credits
CEM101	Building Construction Practices	3-0-0	3
CEM102	Elements of Structural Engineering	3-0-0	3
CEM103	Hydrology and Environmental Engineering	3-0-0	3
CEM104	Soil and Foundation Engineering	3-0-0	3
CEM105	Transportation Engineering	3-0-0	3
Total			**15**

SYLLABI

Minor: Civil Engineering

CEM101 **3-0-0 (3)**

Building Construction Practices

Pre-Requisites: **None**

Course Outcomes:

CO-1	Comprehend the different components of building
CO-2	Map the geospatial features and Identify different navigation systems and constellations
CO-3	Study the construction practices and techniques for the different components of buildings
CO-4	Comprehend the use of Formwork in construction
CO-5	Plan the sequence of construction of Buildings

Syllabus:

Introduction: Types of Buildings, Components of buildings, Foundation and its functional requirements, Characteristics of soil, types of foundations, construction of foundation

Geomatics and Remote sensing: Definition, disciplines and techniques constituting Geomatics, Elements of Cartography- Earth shape, Reference systems and Coordinate systems, Scale, Map Classification and Map reading. Land Surveying, Principles, Distance measuring instruments and methods, Angle measuring instruments and methods, Leveling and Contouring, Applications, Types of maps, Remote Sensing, Electromagnetic spectrum, Global Navigation Satellite System and Geographical Information System

Masonry: Definitions of terms used in masonry, Materials used, Stone masonry, Brick masonry, Different bonds used for brick masonry.

Floors, Roofs and Staircases: Components of a floor, materials used for floor construction, Different types of flooring, Types of roofs, Basic roofing elements and Roof coverings, Functional requirements of a good stair, type of steps, type of stairs, planning a staircase.

Formwork in Construction: Requirements of Formwork, Types of formwork, Timber, Steel, Modular shuttering, Slip forms, Scaffolding.

Planning for Construction: Selection of site for building construction, Sequence of Construction

Learning Resources:

Text Books:

1. P C Varghese, Building construction, PHI Learning Pvt. Ltd., 2016.
2. B C Punmia, A J Jain and A J Jain, Building construction, Laxmi Publications, 2016.

Reference Books:

1. S P Arora and S P Bindra, The text book of building construction, Dhanpat Rai Publications, 2010
2. Handbook on Building Construction Practices (Excluding Electrical Work), SP62 (1997), Bureau of Indian Standards.
3. B.C. Punmia, A K Jain & A K Jain, Surveying Vol I & II, Laxmi publications (P) Ltd, 2005
4. S.K. Duggal, Surveying Vol. II, Tata McGraw Hill Ltd, 2015
5. Introduction to GIS, Kang-Tsung Chang, Tata McGraw-Hill Publishing Co. Ltd, 8e, 2016
6. M Lillesand and W Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, Inc., 2015

Other Suggested Readings:

1. https://www.youtube.com/watch?v=5kt0t5AQBZw
2. https://www.youtube.com/watch?v=XaHpTvUfnfQ
3. https://nptel.ac.in/courses/105/108/105108077/
4. https://nptel.ac.in/courses/105/102/105102015/

CEM102 **3-0-0 (3)**

Elements of Structural Engineering

Pre-Requisites: **None**

Course Outcomes:

CO-1	Visualize, conceptualize and synthesize structural elements
CO-2	Analyse structural elements for bending, shear and torsion
CO-3	Apply design concepts to structural steel elements
CO-4	Apply design concepts to RCC elements

Syllabus:

Introduction to Structural Engineering Concepts: Types of structures, Geometrical and structural classification, Material laws, Laws of structural mechanics, Action and displacement in structures- examples simply supported / hinged beam, Cantilever beam, Use of principle of superposition, Visualize, Conceptualize and Synthesize structural elements.

Concepts of Bending and shear stresses: Assumptions - Theory of Simple Bending - Bending stresses in beams – Flexural shear stress distribution in various shapes of cross section of beams.

Analysis of structural elements: Combined action of bending and shear, shear and torsion, concept of principal stress and strain, structural analysis using tables and charts. Examples on continuous beams.

Methods of Structural steel design and its principles: Introduction-Types of loads- Design Philosophies- working stress method, Limit State Method, Safety factors for Materials and Loads-Indian Standards, Standard sections, General concept in the design of structural elements- tension, compression, beam, column and floor elements.

Concepts of RCC Design: Introduction- Design Philosophies- working stress method, Limit State Method, Safety factors for Materials and Loads-Indian Standards, General concept in the design of structural elements- tension, compression, beam, column and floor elements.

Learning Resources:

Text Books:

1. S Timoshenko, D H Young, J V Rao and S Pati, Engineering Mechanics (In SI Units), McGraw Hill Publishers, 2017.
2. S B Junarkar and H J Shah, Charotar Mechanics of Structures Vol 1 (Strength of Material), Publishing House Pvt. Ltd., 2012.

Reference Books:

1. L S Negi, Design of Steel Structures, Tata Mc Graw Hill Publishers, 2017.
2. Design Of Reinforced Concrete Structures, IS:456-2000, N.Krishnaraju, CBS Publications, 2019.

Other Suggested Readings:

1. https://nptel.ac.in/courses/122/104/122104015/
2. https://nptel.ac.in/courses/112/106/112106180

CEM103 **3-0-0 (3)**

Hydrology and Environmental Engineering

Pre-Requisites: **None**

Course Outcomes:

CO-1	Comprehend the components of hydrologic cycle
CO-2	Explain the various hydrological processes
CO-3	Estimate yield from surface and subsurface resources
CO-4	Assess water demand and identify the components of water treatment systems
CO-5	Estimate the wastewater quantity and comprehend the components of wastewater treatment systems

Syllabus:

Introduction: Description of Hydrologic Cycle, Components of hydrologic cycle, Forms and types of precipitation, Abstractions from Precipitation, Evaporation, Evapotranspiration, Infiltration process, and effective rainfall.

Stream Flow: flow duration curve and flow mass curve, Hydrograph, Basics of unit hydrograph theory, Concepts of flood routing and flood frequency analysis, Occurrence of groundwater, types of aquifers, aquifer properties.

Estimation of Water Demand: water consumption rate, fluctuations in rate of demand, design period, population forecasting methods, working principles and design of water treatment units, screening, plain sedimentation, sedimentation aided with coagulation, filtration, disinfection, water softening, miscellaneous treatments, water distribution.

Wastewater Collection and Transfer: Preliminary & primary treatment of wastewater, secondary treatment of wastewater, disposal.

Learning Resources:

Text Books:

1. K Subramanya, Engineering Hydrology, Tata McGraw Hill Publications, 2020.
2. H S Peavy, D R Rowe and G. Tchobanoglous, Environmental Engineering, McGraw Hill Education, 2017.

Reference Books:

1. P N Modi, Environmental Engineering (Vol. I): Water supply Engineering, Standard Book House, 2018.
2. S K Garg, Environmental Engineering (Vol.II): Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 1999

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/105105201/
2. https://nptel.ac.in/courses/105/106/105106119/

CEM104 **3-0-0 (3)**

Soil and Foundation Engineering

Pre-Requisites: **None**

Course Outcomes:

CO-1	Comprehend the soil as a natural supporting and construction material
CO-2	Calculate 3-phase soil parameters and classify the soils
CO-3	Apply effective stress principle to engineering works
CO-4	Apply the principles of soil compressibility and settlements
CO-5	Comprehend the significance of shear strength and different types of foundations

Syllabus:

Introduction: Soil formation- Development of soil engineering - Importance of soil engineering- Major soil deposits of India and their engineering concerns.

Phase Soil System: 3-phase diagram, basic definitions and formulations, Index properties and soil classification.

Soil-Water: Types of soil- water, permeability of soils, effective stress principle, Estimation of effective stress for different field conditions.

Compressibility and shear strength of Soils:

a) Stresses in soil under applied loads.

b) Compaction of soils – Purpose, IS light and Heavy compaction, compaction quality control.

c) Consolidation of soils- Definitions, total settlement and rate of settlement.

d) Shear strength- Definition and significance of shear strength - Source of shear strength, Mohr's stress circle.

Types of foundations and Bearing Capacity: Importance of bearing capacity, Shallow foundations and Deep foundations, their suitability and selection.

Learning Resources:

Text Books:

1. G Ranjan, A S R Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd, 2016.
2. V N S Murthy, Textbook of Soil Mechanics and Foundation Engineering, CBS, 2018.

Reference Books:

1. B M Das and and N. Sivakugan, Introduction to Geotechnical Engineering, Cengage Learning India Private Limited, 2015.
2. J E Bowles, Foundation Analysis and Design, Mc.Graw Hill Company limited, 1988.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/105105168
2. https://onlinecourses.nptel.ac.in/noc21_ce39/preview

CEM105 **3-0-0 (3)**

Transportation Engineering

Pre-Requisites: **None**

Course Outcomes:

CO-1	Differentiate different systems of transportation
CO-2	Estimate travel demand
CO-3	Analyze the traffic flow data and propose road safety measures
CO-4	Design highway geometrics and flexible pavement
CO-5	Appraise different intelligent transportation systems to ensure effective traffic

Syllabus:

Transportation Systems: Role of transport in national development, the transportation system, modes of transportation and their characteristics, urban and regional transportation problems, travel characteristics, transport development plans, highway classification, and network patterns.

Travel Demand: Issues related to regional and urban transportation planning, long-term and short-term plans, travel attributes, data Collection, four stage travel demand forecasting, Trip Generation Model, Trip Distribution Model, Mode Split Model and Traffic Assignment Technique.

Traffic Engineering and Safety: Traffic characteristics, flow-speed-Density, q-k-v relationships, road traffic studies and analysis, hourly design volume, types of intersections and design considerations, Traffic Signs and Signals, road accidents and measures, Road Safety Analysis and Audit.

Highway Design: Highway alignment, engineering surveys, design control and criteria, cross sectional elements, sight distances, design of horizontal and vertical curves. Types of pavement structures, functions of pavement component layer, basic properties of soil, aggregates, and bitumen, overview of bituminous mix design, Design of flexible pavement

Smart Mobility: Intelligent transportation Systems, advanced vehicle control and safety systems, electronic toll collection, Traveler Information System, Autonomous vehicles, electric trucks, hyperloop and drones.

Learning Resources:

Text Books:

1. S K Khanna and C E G Justo and A Veeraragavan, Highway Engineering, Nem Chand and Bros., 2017.
2. L R Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers, 2018.

Reference Books:

1. D J Findley, B J. Schroeder, C H Cunningham, T H Brown, Jr. Maximize., Highway Engineering, 2015.
2. J Sussman, Introduction to Transportation Systems, 2000.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/101/105101087/
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/