Sardar Vallabhbhai National Institute of Technology

Teaching Scheme and Syllabus
for

Bachelor of Technology
in
Civil Engineering

Minor in Civil Engineering

Department of Civil Engineering

Department of Civil Engineering

Curriculum for B. Tech. Minor in Civil Engineering

Sr. No.	Courses (B. Tech. Minor)	Semester	Code	Scheme L-T-P	Credits
1	Concrete Technology	4th	CE202	3-0-2	4
2	Transport System Design	5th	CE305	3-1-0	4
3	Water Resources Engineering	6th	CE304	3-1-0	4
4	Construction Project Management	7th	CE401	3-1-0	4
5	Mini Project			0-0-4	2
				TOTAL	**18**

CE204 CONCRETE TECHNOLOGY

L	T	P	C
3	0	2	4

1. Course Outcomes (COs):

At the end of the course, the students will be able to

CO1	Evaluate the physical and mechanical properties of ingredients of concrete.
CO2	Conduct the experiments on fresh and hardened concrete.
CO3	Produce a concrete mix compatible to design stipulations.
CO4	Apply the knowledge of special concrete and concreting methods to field.
CO5	Assess in-situ strength of concrete performing the various non-destructive tests.

2. Syllabus

PROPERTIES OF CEMENT (06 Hours)

Manufacturing of Portland cement, Chemical composition of Portland cement, Hydration of cement, Setting of cement, Physical and chemical test for cement, Different types of cement, Important properties and applications

PROPERTIES OF AGGREGATES (06 Hours)

Classification of aggregates, Important physical properties, Mechanical properties, Specific gravity, Bulk density, Moisture content and Water absorption of aggregates, Sieve analysis, Fineness modulus, Grading curves, Gap Grading, Deleterious Substances in aggregates, Alkali-aggregate reaction, Maximum size of aggregates.

MINERAL AND CHEMICAL ADMIXTURES (05 Hours)

Chemical Admixtures, Accelerators, Retarder, Water reducing agents (WRA) or Plasticizers, Air Entraining Agents, Corrosion Inhibitors, Water proofing compounds, Mineral Admixtures-Fly ash, Silica Fume, Ground Granulated Blast Furnace Slag (GGBFS), Metakaolin etc.

FRESH CONCRETE (05 Hours)

Definition of workability, Factors affecting workability, Measurement of workability - Slump test, Compacting factor test, Mixing of concrete ingredients, Types of mixtures, Vibration of concrete, Types of vibrators – Internal vibrators, External vibrators, Table vibrators, Segregation and bleeding.

STRENGTH OF CONCRETE (05 Hours)

Abram's water cement law, Factors affecting strength of concrete, Different methods of Curing, Steam Curing at Atmospheric Pressure and High-Pressure Curing, Warm water method, Maturity of concrete.

TESTING OF HARDENED CONCRETE (06 Hours)

Need for testing, Compression test – Cube, cylinder, Prism and equivalent cube test, Effects of various factors on test results (e.g. End conditions, Capping, Moisture content,

Height/Diameter ratio, Shape of specimen, Size of specimen), Rate of loading, Duration of loading, Comparison of strength of cube and cylinder specimens, Split-tensile test, Flexure test, Non-destructive testing, needs and applications of NDTs, Rebound hammer test, Ultrasonic Pulse Velocity test, Core test.

MIX DESIGN **(06 Hours)**

Definition and need for designing mixes - Methods of mix design – IS 10262 method of mix design in detail with examples.

SPECIAL CONCRETE AND CONCRETING METHODS **(06 Hours)**

Polymer Concrete, Geopolymer concrete, Fibre Reinforced Concrete, Light Weight Concrete, High Density Concrete, Hot and Cold weather Concreting, Ready mixed concrete, Self-compacting concrete, Pre placed aggregate concrete, Vacuum processed concrete, Shotcrete and Gunitting.

(Total Lecture Hours: 45)

3. Practicals

1 To determine fineness of cement.
2 To determine consistency, initial and final setting time of cement.
3 To determine soundness of cement.
4 To determine compressive strength of cement.
5 To determine mechanical properties of fine aggregates.
6 To determine mechanical properties of coarse aggregates.
7 To design a concrete mix of two different grades.
8 To determine workability of concrete and study of effect of super-plasticizers on it.
9 To determine setting time of concrete.
10 To conduct destructive and non-destructive tests on standard concrete cubes.
11 To determine elastic modulus and split tensile strength of concrete.
12 To determine flexural strength of plain concrete

4. Books Recommended

1 A M Neville, Properties of Concrete, Pitman Publishing Company, Bath, U.K., 1973.

2 M S Shetty, Concrete Technology, Theory and Practice" 2nd ed., S. Chand and Company, New Delhi, 1986.

3 M L Gambhir, Concrete Technology, Tata McGraw Hill Company, New Delhi, 1986.

4 Shanthakumar, Concrete Technology, Tata McGraw Hill Company, New Delhi, 2006.

5 G E Troxell and H E Davis, Composition and Properties of Concrete, Mc Graw Hill Publication, 1998.

5. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1	2	0	0	0	0	0	0
CO2	2	2	2	1	1	1	0	0	0	0	0	0
CO3	3	3	2	2	2	1	2	3	1	0	0	0
CO4	1	2	3	3	3	1	1	1	0	0	0	0

CO5	2	2	3	3	2	2	0	2	2	1	0	0

1-Low 2-Moderate 3-High

6. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	1	1	2
CO3	3	2	2
CO4	2	1	2
CO5	2	1	1

1-Low 2-Moderate 3-High

CE 305 Transportation System Design

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

At the end of the course the students will be able to:

CO1	Describe the concept of transportation systems and the challenges involved therein
CO2	Comprehend the basic principles of highway geometric design in the context of transportation engineering and planning
CO3	Comprehend the basics of various transportation structure including Docks and Harbours.
CO4	Apply design criteria for the geometric design of different roadway elements.
CO5	Apply planning and design of airports and railway track elements design.

2. Syllabus

- **UNIT 1: Introduction to Transport Systems (03 HOURS)**
  Introduction to the transportation systems, the role of transportation systems in development of the societies, issues and challenges faced by different transportation systems, Opportunities for transportation specialists in the transportation sector, the historical developments and the current state of the modes.

- **UNIT 2: Framework for Design of Transport Facilities (04 HOURS)**
  Broad steps and framework involved in the design of transport facilities. Available guidelines from Ministry of Housing and urban affairs (MoHUA), Ministry of Road Transport and Highways (MoRTH) and Indian Roads Congress (IRC), Case Studies

- **UNIT 3: Basics of Highway and Geometric Design (08 HOURS)**
  Highway cross section elements, sight distance characteristics of highways, numerical problems, design of horizontal alignment- super elevation, transition curves, extra widening, numerical problems, design of vertical alignment-grades and grade compensation, types of vertical curves and design numerical problems, highway drainage.

- **UNIT 4: Design concept of Pavements (08 HOURS)**
  Types of Pavements, Basic characteristics of materials used in pavements, Variables considered in pavement design, Classification of axle types, standard and legal axle loads, tyre pressure, contact pressure, ESWL, EWLF and EAL concepts, Traffic analysis: ADT, AADT, truck factor, growth factor, lane distribution factor, directional distribution factor and vehicle damage factor. Design concept of flexible and rigid pavements. Layered system concepts; Stresses in Rigid Pavement. Basic introduction of IRC codes and practice.

- **UNIT 5: Basics of Railway Track Engineering and Design (06 HOURS)**
  Railway track gauge, alignment and surveys, stresses in tracks, rails, sleepers and ballast, subgrade and formation, track fittings and fastenings, creep of rail and geometric design of track.

- **UNIT 6: Basics of Airport Engineering and design (04 HOURS)**
  Aircraft characteristics related to airport design, Airport classification, runway orientation: wind rose diagram, runway length, runway system spacing, taxiways and aprons.

- **UNIT 7: Transportation Structures (06 HOURS)**
  Types – Culverts, Bridge, fly-overs, tunnels, components, classification, requirements, site selection, alignment, bridge sub structure, Bridge Super Structure – Super structure elements, bridge flooring, slab bridges and girder bridges, bridge bearings, joints in bridges, piers, abutments, wing walls and approaches.

- **UNIT 8: Docks and Harbours (06 HOURS)**
  Harbours and Ports: Classification of ports, requirements of a good port, classification of harbour, harbor planning, requirements of harbour, Docks and Spillways - Introduction, advantages of docks, moles, shape of docks and basins, dock entrance, entrance docks, quays, jetties and wharves, tide, wind and wave, dry dock, types of breakwaters.

(Total Lectures: 45 hours, Tutorials: 14 hours)

3. Books Recommended

1. J.H. Banks, Introduction to Transportation Engineering, McGraw-Hill, New York.
2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, 3rd Ed., Prentice Hall, New Jersey.
3. Fred L. Mannering, Scott S.Washburn and Walter P.Kilareski; Principles of Highway Engineering and Traffic Analysis, Wiley India.
4. S. K. Khanna., C. E. G. Justo and A. Veeraragavan; Highway Engineering- Nem Chand Bros, India.
5. Satish Chandra, M.M.Agarwal; Railway Engineering, Oxford University Press, New Delhi, India.
6. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright; Airport Engineering: Planning, Design and Development of 21st Century Airports, Wiley, New Jersey, USA
7. Robert Horonjeff, Francis X. McKelvey, William J. Sproule, Seth B. Young; Planning and Design of Airports, McGraw-Hill Companies, New York, USA.
8. S P Bindra, Bridge Engineering, Dhanpat Rai and Sons, New Delhi, 2012.
9. R. Srinivasan Harbour Dock and Tunnel Engineering, Charotar Publishing, 2016.

CODES

1. **IRC: 37-2018***Guidelines for the Design of Flexible Pavements*, The Indian Roads Congress, New Delhi, India, 2018.
2. **IRC:58-2015***Guidelines for the Design of Plain Jointed Rigid Pavements for Highways*, The Indian Roads Congress, New Delhi, India, 2015.

4. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	0	1	2	3	1	0	0	0	0
CO2	2	0	0	0	1	1	3	1	0	1	1	0
CO3	3	1	1	0	0	0	1	2	3	3	1	0
CO4	3	1	1	0	0	0	1	2	3	3	1	0
CO5	3	1	1	0	0	0	1	2	3	3	1	0

0-Not related 1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	1	2	1
CO2	2	2	2
CO3	3	2	1
CO4	3	2	1
CO5	1	1	1

0-Not related 1-Low 2-Moderate 3-High

CE 304 Water Resources Engineering

L	T	P	C
3	1	2	5

1. Course Outcomes (COs)

At the end of the course the students will be able to:

CO1	Estimate precipitation and abstractions.
CO2	Compute runoff and hydrographs and groundwater flow.
CO3	Analyze irrigation water requirements.
CO4	Explain important hydraulic structures.
CO5	Explain the aspects of water logging and drainage.

2. Syllabus

• INTRODUCTION TO WATER RESOURCES ENGINEERING (02 Hours)

Introduction, importance of water resources engineering, need of water resources projects

- **PRECIPITATION AND ABSTRACTIONS (10 Hours)**

Mechanism of precipitation, types and forms of precipitation, measurement techniques, rain gauge network, variability in precipitation, estimation of missing data, test for consistency of rainfall record, rainfall hyetograph, rainfall mass curve, areal average rainfall, intensity duration curves, evaporation, factors affecting evaporation, estimation of evaporation, evapotranspiration, measurement of evapotranspiration, initial loss, infiltration and infiltration indices.

• RUN-OFF AND HYDROGRAPH (08 Hours)

Direct runoff and base flow; run off characteristics of streams, computation of runoff, rainfall runoff relationships, components of hydrograph and factors affecting shape of hydrograph, base flow separation, effective rainfall hyetograph, unit hydrograph theory, derivation of unit hydrograph of different duration

• GROUND WATER HYDROLOGY (08 Hours)

Occurrence, distribution of ground water, specific yield of aquifers, flow of groundwater, Darcy's law, permeability, safe yield of a basin, compressibility of aquifer, storage coefficient, specific storage, hydraulics of wells under steady and introduction to unsteady condition in confined and unconfined aquifers, yield of wells, pumping and recuperation tests, types of tube wells.

- **WATER REQUIREMENTS OF CROPS (06 Hours)**

  Classes and availability of soil water, available moisture depth, frequency of irrigation, relationship between duty, delta and base period, factors affecting duty, methods of improving duty, irrigation efficiencies, command areas, kharif, rabi and perennial crops, crop rotation, irrigation water requirement, design discharge of canal and storage capacity of reservoir based on irrigation requirement, types and methods of irrigation

- **HYDRAULIC STRUCTURES (08 Hours)**

  Introduction to various hydraulic structures including necessity, location, types of dams, investigations for reservoir planning, site selection, storage zones, yield, spillways, energy dissipation structures, canal falls, cross regulators, head regulators, canal escapes, canal outlets, cross drainage works. Important aspects of design of hydraulic structures.

- **WATER LOGGING AND DRAINAGE (03 Hours)**

  Definition, effects, causes and remedial measures of water logging, types of land drains, layout and spacing of tile drains, Leaching and salinity control.

[Total Lecturers: 45 hours, Tutorials: 15 hours]

3. Books Recommended

1. V P Singh, Elementary Hydrology, Prentice Hall, Englewood Cliffs, 1992.
2. K Subramanya, Engineering Hydrology, Tata Mc-Graw-Hill, New Delhi, 2013.
3. S K Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi, 2011.
4. B C Punmia, Irrigation and Water Power Engineering, Laxmi Publications, New Delhi, 2016.
5. G L Asawa, Irrigation and Water Resources Engineering, New Age International, New Delhi, 2014.

5. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3	1	1	1	1	3	1	1
CO2	3	1	1	1	3	1	1	1	3	2	1	1
CO3	2	1	2	3	1	2	2	2	2	1	1	1
CO4	1	1	3	2	1	1	1	1	1	3	2	2
CO5	3	3	3	1	2	3	3	3	1	1	3	3

1-Low 2-Moderate 3-High

6. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	1	2	3
CO5	2	1	3

1-Low 2-Moderate 3-High

CE 401Construction Project Management

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

At the end of the course the students will be able to:

CO1	Apply project management principles to manage heavy construction projects.
CO2	Develop and implement construction project planning, scheduling and control processes.
CO3	Assess project feasibility and conduct financial appraisals for heavy construction projects.
CO4	Evaluate and select appropriate construction equipment and estimate equipment-related costs.
CO5	Utilize advanced project management tools and techniques to optimize project outcomes.

2. Syllabus

- **CONSTRUCTION PROJECTS (06 Hours)**
  Concept of project and its features, characteristics of construction projects, project life cycle, lean construction, construction project management practice, functions and principles of management, organization of construction project, project categories, project planning & organization systems, heavy construction projects, project success strategies, construction industry in India.

- **PROJECT MANAGEMENT (15 Hours)**
  Work scope planning, project work breakdown structures, bar and milestone charts, network analysis fundamentals, network elements, network development, network development and analysis, PERT, CPM, precedence network analysis, line of balance, network updating, resource allocation and scheduling, levelling & smoothing, time–cost analysis, quality assurance and control, material and human resource management, construction safety management, disputes and resolution techniques, monitoring and control.

- **PROJECT FINANCE AND APPRAISAL (08 Hours)**
  Need & types of project appraisals, concepts of financial appraisal, finance source for heavy construction projects, methods of financing the heavy construction projects, major financing bodies, economic appraisal of project, Indian practice of investment appraisal, time value of money, analysis of risk, discounted and non-discounted cash flow methods, feasibility study.

- **CONSTRUCTION EQUIPMENT (10 Hours)**
  Classification of construction equipment, types & characteristics of heavy construction equipment, equipment capacities & costs, machine power, dozers, scrapers, excavators, trucks & hauling equipment, draglines & clamshells, pile driving equipment, selection of equipment, acquisition of equipment, time value of money for heavy construction equipment, depreciation.

- **ADVANCED PROJECT MANAGEMENT (06 Hours)**

Earned value analysis, Project management information systems, IT applications in project management, project document management, cloud computing, cloud economics, project management software, web-based construction project management, building information modelling (BIM) for construction project management.

(Total Lectures: 45 hours)

3. Books Recommended

1. K N Jha, Construction Project Management: Theory and Practice, Pearson Education, New Delhi, 2015.
2. K K Chitkara, Construction Project Management: Planning, Scheduling & Controlling, 3rd Edition, Tata McGraw - Hill Publishing Co. Ltd., New Delhi, 2014.
3. P Chandra, Projects: Planning, Analysis, Selection, Financing, Implementation, and Review, Tata McGraw-Hill, New Delhi, 2009.
4. R L Peurifoy, Construction Planning, Equipment, and Methods, Tata McGraw-Hill, New Delhi, 2002.
5. F Harris and R McCaffer, Modern Construction Management, Seventh Edition, Blackwell Publishers, Oxford, 2013.
6. James Douglas and Bill Ransom, Understanding Building Failures, 4th Edition, Routledge, 2013.

4. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	1	3	3	3	2	3	3	2
CO2	3	3	3	3	2	3	2	2	3	3	3	3
CO3	2	3	3	2	2	3	3	2	2	3	3	3
CO4	3	3	3	3	2	2	3	2	3	3	2	2
CO5	3	3	3	2	3	2	3	2	2	3	3	3

-Not related 1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	2	3	3

-Not related 1-Low 2-Moderate 3-High

CE xxx Mini Project

L	T	P	C
0	0	4	2

1. Course Outcomes (COs)

At the end of the course the students will be able to:

CO1	Identify problems that have relevance to the current industrial needs and be aware about current innovative practices and technology.
CO2	Conduct literature survey in the chosen field and discover research gap from the existing literature.
CO3	Apply various engineering and management topics according to real site conditions.
CO4	Identify the problems which can occur during the execution of the project and find solutions to the problems using various construction management tools and techniques.
CO5	Develop technical writing, presentation and communication skills.

2. Syllabus

Project is aimed at identification of the research area and formulation of the research objectives for a particular study. Students are expected to carry out independent research work on the chosen topic and submit duly computer typed reports, present and participate in subject wise group discussion. The work at this stage may involve extensive review of literature, identify research gaps, case study, identify research problems, field data collection and analysis and be aware of current technologies.

3. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

-Not related 1-Low 2-Moderate 3-High

4. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

-Not related 1-Low 2-Moderate 3-High