Master of Technology

In

Civil Engineering (Transportation)

Course Structure & Syllabus

Department of Civil Engineering

National Institute of Technology Hamirpur

Hamirpur (HP) – 177005, India

SEMESTER-I

S No.	Course No.	Course Name	L	P	Hours/ week	Credit
1	CE-671	Applied Statistics	4	0	4	4
2	CE-672	Pavement Design	4	0	4	4
3	CE-673	Urban Transportation Planning	4	0	4	4
4	CE-674	Highway Engineering Lab	0	4	4	2
5	CE-7MN	Program Elective-I	4	0	4	4
6	CE-7MN	Program Elective-II	4	0	4	4
	Total		**20**	**4**	**24**	**22**

Program Elective-I & II: Any course listed in Annexure-I (List of Electives)

SEMESTER-II

S No.	Course No.	Course Name	L	P	Hours/ week	Credit
1	CE-681	Pavement Construction and Maintenance	4	0	4	4
2	CE-682	Traffic Engineering	4	0	4	4
3	CE-683	ITS and Road Safety	4	0	4	4
4	CE-684	Traffic Engineering lab	0	4	4	2
5	CE-7MN	Program Elective-III	4	0	4	4
6	CE-70N	Institute Elective	4	0	4	4
	Total		**20**	**4**	**24**	**22**

Program Elective–III: Any course listed in Annexure-I (List of Electives)

SEMESTER-III

S No.	Course No.	Course Name	Hours/week	Credit
1	CE-798	M Tech Dissertation	--	18
	Total			**18**

SEMESTER-IV

S No.	Course No.	Course Name	Hours/week	Credit
1	CE-799	M Tech Dissertation	--	18
	Total		**--**	**18**

Total Credits of the Program: 80

Annexure I: List of Program Elective Courses

	Course No	Course Title
Program Electives	CE-773	Transportation Environmental Interaction
	CE-712	Ground Improvement Techniques
	CE-770	Remote Sensing and GIS
	CE-746	Railways, Airports & Waterways
	CE-736	Disaster Management
	CE-740	Optimization Methods
	CE-741	Construction Management
	CE-747	Design of Highway and Railway Bridges

Annexure II: List of Institute Elective Courses

	Course No	Course Title
Institute Electives	CE-701	Project Management
	CE-702	Disaster Management
	CE-703	Environmental Impact Assessment
	CE-704	Remote Sensing & GIS
	CE-705	Engineering Seismology

Course Name: **Applied Statistics**
Course Code: **CE-671**
Course Type: **Core**

Contact Hours/Week: **4** Course Credits: **4**

Course Objectives

- To understand basic statistical techniques
- To develop the skills of applying probability and statistics in solving transportation problems

Course Content

Elements of Probability Theory, Linear and Non-linear Regression, Experimental Data and Model Parameters, Transportation and Assignment problems. Dynamic programming, Queuing theory, Decision theory, Hypothesis Testing and Model Evaluation, Computer Simulation.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Perform linear and non-linear regression

CO2: Perform hypothesis testing

CO3: Apply queuing theory in Traffic Engineering problem

Books and References

1. Urban transportation networks: Equilibrium analysis with mathematical programming methods. Sheffi, Y. New Jersey.
2. Probability, statistics, & decision for Civil Engineers, Benjamin J.R. & Comell G.A., Dover Publications.
3. Probability Concepts in Engineering, Planning and Design. Ang, H.S. and Tang, W.H., Wiley.
4. Introductory Mathematical Statistics. Kreyszig, E., Wiley.

Course Name: **ITS and Road Safety**
Course Code: **CE-683**
Course Type: **Core**

Contact Hours/Week: **4** Course Credits: **4**

Course Objectives

- Gain knowledge of emerging and existing ITS applications and standards
- Gain knowledge on road safety aspects

Course Content

Components of Intelligent Transportation Systems (ITS): ATIS, ATMS, ADAS, etc.; ITS data collection technologies and supporting systems, ITS applications in Transportation system management: Traffic operations/congestion management, Public transportation, Freight and commercial vehicle operations, Electronic tolling and pricing, Personal transportation, Rural and regional transportation, Sustainable transportation, Connected and autonomous vehicles (C&AV); International ITS Programs, Standards and policies; ITS Highway Safety Perspective, road safety, case studies

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Describe the role of ITS and its benefits and challenges in improving the transportation experiences of users and system managers.

CO2: Understand/Appreciate ITS applications in various transportation modes and safety.

CO3: Review the cutting-edge of ITS applications and visualize the evolution of transportation in the near future.

Books and References:

1. Sussman, Joseph. Perspectives on Intelligent Transportation Systems (ITS). New York, NY: Springer, 2010.
2. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2003.

Course Name: **Traffic Engineering Lab**
Course Code: **CE-684**
Course Type: **Core**

Contact Hours/Week: **4** Course Credits: **02**

Course Objectives

- To learn methods of data collection and analysis through field surveys
- To learn analysis of traffic data through traffic lab

Course Content

Driver vision testing, spot speeds study, moving observer method, origin destination surveys using licence plate method, Parking usage study, acceleration deceleration characteristics of vehicles, intersection studies (volume and delay), gap acceptance study, pedestrian behavior study.

NOTE: The concerned course coordinator will prepare the actual list of experiments/problems at the start of semester based on above generic list

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Understand and implement data collection procedures for transportation studies

CO2: Collect and analyze fundamental parameters of vehicular and pedestrian traffic flow

CO3: Apply mathematical techniques to study traffic characteristics

Books and References:

1. S.K. Khanna and C.E.G. Justo, Highway Engineering, Khanna Publishers, Roorkee
2. J.H. Banks, Introduction to Transportation Engineering, McGraw-Hill, New York, 2002.
3. Fred L. Mannering, and Scott S. Washburn, Principles of highway engineering and traffic analysis.
4. Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C, 2022
5. L.R. Kadiyali, Principles and Practice of Highway Engineering, Khanna Technical Publications
6. Indo-Highway Capacity Manual, New Delhi, 2019
7. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, 3rd Ed., Prentice Hall, New Jersey, 2001

Course Name: **Traffic Engineering**
Course Code: **CE-682**
Course Type: **Core**

Contact Hours/Week: **4** Course Credits: **04**

Course Objectives

- To introduce fundamental knowledge of traffic engineering
- To make the students learn to deal with traffic issues including traffic safety, operation and control.

Course Content

Traffic data collection, Traffic flow characteristics, vehicle and human characteristics, Traffic flow modeling and simulation, Highway capacity and level of service, Intersection control and design, Intersection capacity and level of service, traffic safety, Traffic signs, signals, and road markings, Traffic calming and control measures, Road lighting

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Identify traffic stream characteristics

CO2: Design a pre-timed signalized intersection, and determine the signal splits

CO3: Assess level of services of roadway facilities

Books and References

1. Transportation Engineering: An Introduction. Khisty, Lall, Pearson
2. Principles of Traffic Engineering. G.J. Pingnataro, Mc Graw-Hill.
3. Traffic System Analysis for Engineering and Planners. Wohl and Martin., Mc Graw Hill.

Course Name: **Pavement Design**
Course Code: **CE-672**
Course Type: **Core**

Contact Hours/Week: 4 Course Credits: **04**

Course Objectives

- To impart knowledge about pavement materials and design
- To introduce the fundamental concepts of pavement designing
- To enable the students to understand the importance of design features of pavements

Course Content

Characteristics of pavement materials-soil, aggregates, bitumen, and cement; bitumen grading system, hot mix asphalt mix design, cement concrete mix design, factors affecting pavement design, stresses in flexible and rigid pavements, IRC method of flexible and rigid pavement design, design of low volume rural roads

Course Outcomes

Upon successful completion of the course, the students will be able to
CO1: carry out the design of flexible pavement
CO2: carry out the design of rigid pavements
CO3: understand the factors that affect pavement designing
CO4: understand the important features of pavement designing

Books/References:

1. Huang, Y. H. (2004) "Pavement Analysis and Design.

Course Name: **Pavement Construction and Maintenance**
Course Code: **CE-681**
Course Type: **Core**

Contact Hours/Week: **4** Course Credits: **04**

Course Objectives

- To impart knowledge about pavement construction and maintenance
- To introduce the fundamental concepts of highway construction
- To enable the students to understand the importance of right construction methodology

Course Content

bituminous paving mixes and surface treatments, hot mix asphalt production and construction, asphalt pavement distresses, causes and treatments, maintenance and rehabilitation of asphalt pavements, recycling of asphalt pavements, construction and maintenance of rigid pavements, new technologies in pavement construction

Course Outcomes

Upon successful completion of the course, the students will be able to
CO1: understand the construction of flexible pavement
CO2: understand the construction of rigid pavement
CO3: understand the factors that affect flexible pavement construction methodology
CO4: understand the factors that affect rigid pavement construction methodology

Books and References

1. Prithvi Singh Kandhal, Bituminous road construction in India
2. S. K. Khanna, C.E.G Justo, Highway Engineering

Course Name: **Urban Transportation Planning**
Course Code: **CE-673**
Course Type: **Core**

Contact Hours/Week: **4** Course Credits: **04**

Course Objectives

- To impart knowledge about urban transportation planning
- To introduce the fundamental concepts of urban transportation planning
- To enable the students to understand the importance of urban transportation planning

Course Content

Urban transportation planning, Land use and transportation interaction, Transportation economics, Travel demand forecasting: trip generation, trip distribution, mode choice, and traffic assignment, Public transportation planning, Passenger and freight movement in urban and regional contexts, Air quality, noise, and energy impacts of transportation, Urban area traffic management: pedestrian facilities, bicycle facilities, parking and terminal facilities, Transportation system management (TSM), Evaluation and choice of transportation projects.

Course Outcomes

Upon successful completion of the course, the students will be able to
CO1: understand the urban transportation system
CO2: understand the urban transportation planning
CO3: understand the factors that affect urban transportation system
CO4: understand the factors that affect urban transportation planning

Books and References

1. Dickey, J.W.,Metropolitan transportation planning, McGraw Hill, Inc.
2. C. J. Khisty and B. K. Lall, Transportation Engineering
3. Morlok,E.R., An Introduction to Transportation Engineering and Planning, McGraw Hill, Inc., Kagakusha. Hutchinson, B., Principles of Urban transportation Planning, McGraw Hill, Inc.
4. Vuchic, V. R. (1981), Urban public transportation; Systems and technology, Prentice-Hall, Englewood Cliffs, New Jersey

Course Name: **Highway Engineering Lab**
Course Code: **CE-674**

Contact Hours/Week: **4** Course Credits: **02**

Course Objectives

- To provide skills for testing pavement materials
- To provide skills for traffic studies on different roadway facilities

List of Experiments

1. California Bearing Ratio test for a soil sample
2. Marshall stability test
3. Rutting test for asphalt mixture
4. Test of Skid Resistance on pavement surface
5. Bitumen characteristics tests: Penetration, softening point, ductility, etc.
6. Aggregate characteristics tests: crushing value, impact value, gradation, abrasion value, etc.

NOTE: The concerned course coordinator will prepare the actual list of experiments/problems at the start of semester based on above generic list

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Conduct different tests on road construction materials

CO2: Test skid resistance and unevenness of pavement surface

CO3: Measure traffic flow parameters in the field

Course Name: **Design of Highway and Railway Bridges**
Course Code: **CE-747**
Course Type: **Programme Elective**

Contact Hours/Week: **4** Course Credits: 04

Course Objectives

- To impart knowledge about designing of bridges
- To introduce the fundamental concepts pf bridge designing
- To enable the students to understand the importance of design features of bridges

Course Content

Investigation and site selection, hydraulic factors, alignment, traffic aspects, types of bridges; loading standard, IRC specification, impact factor, general design consideration, structural design of highway and railway bridges in masonry, reinforced, pre-stressed concrete and steel; superstructures: slab bridge, beam and slab bridge, plate girder and composite bridges, bearings and expansion joints, bridge foundation: types of foundation, design of well and pile foundation, bridge vibration: traffic loading, seismic and wind effect, construction techniques and maintenance.

Course Outcomes

Upon successful completion of the course, the students will be able to
CO1: carry out the design of highway bridges
CO2: carry out the design of railway bridges
CO3: understand the factors that affect bridge designing
CO4: understand the important features of bridge designing

Books and References

1. Victor, D.J. "Essentials of Bridge Engineering, Oxford and IBH, 1980.
2. N. Kridhna Raju "Design of Bridges, Oxford and IBH, 1988

Course Name: **Railways, Airports and Waterways**
Course Code: **CE-746**
Course Type: **Programme Elective**

Contact Hours/Week: **4** Course Credits: 04

Course Objectives

- To impart knowledge about designing of airports and waterways
- To introduce the fundamental concepts pf airport and waterway designing
- To enable the students to understand the importance of design features of airports and waterways

Course Content

Components of Railway System, Elements of permanent way: Rails, Sleepers, Ballast, rail fixtures and fastenings, Track Stress, coning of wheels, creep in rails, signaling and interlocking; Railway Planning, Geometric design of railways, gradient, super elevation, Points and Crossings, Railway stations and yards, Tunneling; Airport Planning, Airport classification, Airport components, criteria for airport site selection, Typical airport layouts, Airport Zones, Airport Design, Runway Design and orientation, Wind Rose Diagram, Taxiway design, Runway Pavement Design Principles, Airport Markings and lighting, ATC; Ports and Harbors, Layout of ports, docks, and harbors, coastal protection structures, signals, Inland water transport

Course Outcomes

Upon successful completion of the course, the students will be able to
CO1: carry out the design of airports
CO2: carry out the design of waterways
CO3: understand the factors that affect airport and waterways designing
CO4: understand the important features of airport and waterways designing

Books and References

1. A Course in Railway Engineering by Saxena Subhash C and Satyapal Arora, Dhanpat Rai and Sons
2. Airport Planning and Design by Khanna S K, Arora M G and Jain S S, Nemchand and Brothers, Roorkee
3. Transportation Engineering Vol.-II by C Venkatramaiah
4. Port and Harbor Engineering byR P Rethaliya, Atul Prakashan

Course Name : **Remote Sensing and GIS**
Course Code : **CE-770**
Course Type : **Programme elective**

Contact Hours/Week: **4** Course Credits: **04**

Course Objectives

- Understanding the need of CAD and GIS,
- Understanding map projection and working with coordinate systems,
- Understanding vector-based and raster-based data data analysis,
- Review of application areas of GIS in Civil Engineering, and
- Understanding basic principles of remote sensing.

Course Content

Introduction to Remote Sensing, data acquisition and processing, Electromagnetic Radiation (EMR) and its characteristics, Radiation principles, properties of solar radiant energy, atmospheric windows. Interaction in the atmosphere, nature of atmospheric interaction, atmospheric effects of visible, near infra-red thermal and microwave wavelengths, interaction at ground surface, interaction with soils and rocks, effects of soil moisture, organic matter, particles, size and texture, interaction with vegetation, spectral characteristics of individual leaf, vegetation canopies, effect of leaf pigments, radiation geometry. Introduction to GeographicalInformation Systems, Definition of GIS, Difference between GIS and CAD worlds, utility of GIS, various GIS packages and their salient features, essential components of a GIS, scanners and digitizers. Map projection and coordinate systems: Introduction, geographic Grid, Map projection, Coordinate systems. Vector data models and Analysis: vector data and its representation, topological data structure, non- topological vector data structure, TIN, Region, vector data editing and analysis. Raster data models and Analysis: acquiring and handling of raster data storage, function of raster based GIS data analysis. Engineering applications of GIS: applications of GIS in civil engineering.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Understand the principles of remote sensing,
CO2: Understand the principles of geographic information systems,
CO3: Apply remote sensing and GIS to solving problems of Civil Engineering,
CO4: Maximize the efficiency of planning and spatial decision making, and
CO5: Integrate geographically referenced data and develop queries to generate usable information.

Books and References

1. Remote Sensing and Image Interpretation : T.M. Lillensand and R.W. Keifer
2. Principles of Remote Sensing : P.J. Curren
3. Concept and Techniques of Geographical Information systems : C.P. Lo and Albert K.W.Yeung
4. Introduction to Geographical Information systems : Kang-tsung Chang
5. Geographical Information systems- A Management Perspective : Stan Aromoff

Course Name : **Transportation Environment Interaction**
Course Code : **CE-771**
Course Type : **Programme Elective**

Contact Hours/Week: 4 **Course Credits:** 04

Course Objectives

- To impart the knowledge of how transportation facilities affecting the environment
- To make the students understand the noise sources and its mitigation for urban and non-urban transportation
- To make the students understand different vehicle emission parameters, pollution standards and its mitigation strategies

Course Content

Transportation Safety: Pre-crash, Crash and Post-crash models; Roles of vehicle, roadway, traffic, driver and environment; Crash and injury causations Modes of Transportation, Mixed Traffic Flow, Transport Related Pollution, Technology Vision-2020, Urban and Non-urban Traffic Noise, Noise Sources, Noise Level Factors, Effects of Traffic Noise, Noise Standards. Measurement and Prediction, Control Measures, Noise Studies, Road Transport related air pollution, Sources of air pollution, effects of weather conditions, Vehicular emission parameters, Pollution standards, measurement and analysis of vehicular emission, Mitigative measures, EIA requirements of Highway Projects, procedures, Ministry of Environment and Forests (MOEF)/World Bank/IRC/UK Guidelines, EIA Practices in India.

Course Outcomes

Upon successful completion of the course, the students will be able to
CO1: Map traffic noises
CO2: Model vehicle emission for given conditions
CO3: Design transportation facility ensuring less environmental impact as per standard guidelines

Books and References

1. Road Traffic Noise by Alexandra, A., Lamure, C. and Langdon, F.J., Applied Science Publishers Limited, London.
2. Highway Traffic Analysis and Design by Salter, R.J., Macmillan Press Limited, London.
3. Noise Control Management, Analysis and Control of Sound and Vibration by Wilson, C.E., Harper and Row Publishers, New York.
4. Environmental Factors in Urban Planning by Grand Jean, E., and Gilgen, A., Taylor and Francis Limited, London

Course Name: **Ground Improvement Techniques**
Course Code: **CE-712**
Course Type: **Program Elective**

Contact Hours/Week: **4** Course Credits: **4**

Course Objectives:

- To understand soil characteristics in the field
- Know about the methods and design of right kind of ground improvement techniques required for the actual field situation.

Course Content

Introduction: Need and objectives of ground improvement, emerging trends in ground improvement, methods of de-watering, horizontal wells-foundation drains-blanket drains, criteria for selection of fill material around drains, electro-osmosis. Compaction: Principles of compaction, laboratory compaction, engineering behavior of compacted clays, field compaction techniques- static, vibratory, impact, Earth moving machinery, compaction control, compaction using vibratory probes, vibro techniques, vibro equipment, vibro systems and liquefaction, soil improvement by thermal treatment, preloading techniques, vibro floatation, dynamic compaction, introduction to biotechnical stabilization. Shallow stabilization: Shallow Stabilization with additives such as lime, fly ash, cement and other chemicals and bitumen. Deep stabilization: Sand column, stone column, sand drains, prefabricated drains, electro-osmosis, lime column, soil-lime column. Grouting: Chemical grouting, commonly used chemicals, grouting systems, jet grouting, jet grouting process, permeation, grouting, thermal, freezing, dewatering systems.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Understand the concept of the various ground improvement techniques.

CO2: Choose the right kind of ground improvement techniques required for the actual field situation

CO3: Identify the weakness of soil

Books and References:

1. Ground Improvement Techniques by P. Purushothama Raj, Laxmi Publications.
2. Ground Improvement by M.P. Moseley and K. Kirsch, Spon Press.
3. Ground Control and Improvement by Petros P Xanthakos, Lee W Abramson and Donald A Bruce, Wiley Interscience.

Course Name: **Disaster Management**
Course Code: **CE-736**
Course Type: **Programme Elective**

Contact Hours/Week: **4** Course Credits: **04**

Course Objectives

- To impart knowledge about the disaster Management
- To introduce the fundamental concepts relevant to various aspect of disaster
- To enable the students to understand the factors that cause the disaster.
- To be able to assess risk and vulnerability for natural and man-made hazard

Course Content

Introduction to Natural & Man-made Disasters: Understanding Disasters, Geological and Mountain Area Disasters, Wind and Water Related Natural Disaster, Man Made Disasters Technologies for Disaster Management Role of IT in Disaster Preparedness, Remote Sensing, GIS and GPS, Use and Application of Emerging Technologies, Application of Modern Technologies for the Emergency communication, Application and use of ICST for different disasters. Rehabilitation, Reconstruction and Recovery: Introduction and basic concept; Disaster Response And Management: Introduction to Response Essential Components, Stakeholders Co-ordination in Disaster Response, Human Behavior and Response Management and Relief Measures; Behavior and Response Management and Relief Measures; Disaster Mitigation: meaning and concept, Disaster Mitigation Strategies, Emerging Trends in Disaster Mitigation, Mitigation management, Role of Team and Coordination.

Course Outcomes

1. After learning the course, the students should be able to:
2. Understand disasters, disaster preparedness, role of IT, remote sensing, GIS and GPS,
3. Understand Rehabilitation, Reconstruction and Recovery,
4. Apply knowledge Disaster Response and Management, Risk Assessment and Vulnerability Analysis,
5. Understand Disaster Mitigation.

Books and References

1. Natural Hazards by Bryant Edwards, Cambridge University Press, U.K.
2. Disaster Management by Carter, W. Nick, Asian Development Bank, Manila.
3. Disaster Mitigation Experiences and Reflections by Sahni, Pardeep et.al., Prentice Hall of India, New Delhi.
4. Space Technology for Disaster management: A Remote Sensing & GIS Perspective by Roy, P.S. IIRS (NRSA) Dehradun.
5. Natural Disaster by Sharma, R.K. & Sharma, G. APH Publishing Corporation, New Delhi.
6. Disaster Management in the Hills by Singh Satendra, Concept Publishing Company, New Delhi.
7. Disaster Management through Panchayati Raj by Taori, K, Concept Publishing Company, New Delhi.

Course Name: **Optimization Methods**
Course Code: **CE-740**
Course Type: **Programme Elective**

Contact Hours/Week: **4** Course Credits: **04**

Course Objectives

- To impart knowledge about the optimization
- To impart knowledge about the multi-objective nature of Engineering Design
- To Apply optimization methods to solve the Engineering Design Problems

Course Content

Basics of engineering analysis and design, need for optimal design, formulation of optimization problem, classical-simplex search, gradient search, Newton Raphson and global Optimization techniques- Introduction to GA, Constrained and Unconstrained optimization problems, convex optimization, Sensitivity analysis, Numerical methods for nonlinear optimization problems.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Understanding the basic concepts of classical optimization
CO2: Analysis of optimization algorithms
CO3: Applications of optimization in Civil Engineering

Books and References

1. Optimization for engineering design: Algorithms and examples by K. Deb, PHI Pvt Ltd.
2. Introduction to optimum design by J.S. Arora, McGraw Hill International editions.
3. Elements of structural optimization by R.T. Hafta and Z. Gurdal, Kluwer academic publishers.
4. Engineering Optimization theory and Practice by S. S. Rao, New Age International.

Course Name : **Construction Management**
Course Code : **CE-741**
Course Type : **Programme elective**

Contact Hours/Week: **4** Course Credits: 03

Course Objectives

- Understanding the need of construction planning,
- Understanding planning and scheduling using critical path method,
- Understanding planning and scheduling using PDM, and
- Understanding scheduling of repetitive construction projects.

Course Content

Construction Planning: Owner level planning**,** pre-tender stage planning, contract stage planning; **Construction Contracts:** Contract act, types of contracts, tender and condition of contract, tender notice, pre requisites for tendering, tender document, EMD, Receipt and opening of tenders, evaluation of tenders, award of contract, Legal aspect of contract; **Critical Path Method (CPM) for scheduling of simple construction projects:** Work breakdown structure, developing networks, AOA and AON representation of network, activity times, activity floats, critical path method; **Precedence Diagram Method (PDM) for scheduling of complex construction projects**: Precedence networks fundamentals, advantages, logic and precedence networks applications, PDM versus CPM; **Line of Balancing (LOB) for scheduling of repetitive construction projects:** Line of balance methods of scheduling repetitive construction, time and space buffers, linear interpretation of precedence relationships; **Selection of Planning Techniques for construction projects**: Selection of planning and scheduling techniques, Techniques for different level of management, level of detail needed, project success or failure.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Plan and schedule construction project by Critical path method,
CO2: Plan and schedule construction project by PDM,
CO3: Apply LOB to solving problems of repetitive construction planning

Books and References

1. Chitkara, K. K. “Construction Project Management, planning scheduling and controlling.”
2. Bansal V. K. “Project management:Planning and Scheduling Techniques.”
3. Moder J. J. Philips, C.R. and Davis, E.W. “Project Management with CPM and PERT, and precedence diagramming”
4. Pilcher, R. “Project Cost Control in Construction”. Brien J.J. CPM in “Construction Management”, Mc. Graw Hill.