

M Tech (Infrastructure Engineering and Management)

SEMESTER - 1

Course No.	Course Name	L - T - P - C
CE 541	Infrastructure Planning	3 - 0 - 0 - 6
CE 542	Project Management in Construction	3 - 0 - 0 - 6
CE 543	Construction Methods and Equipment Management	3 - 0 - 0 - 6
XX xxx	Elective I	3 - 0 - 0 - 6
		12 - 0 - 0 - 24

SEMESTER - 2

Course No.	Course Name	L - T - P - C
CE 614	Financing Infrastructure Projects	3 - 0 - 0 - 6
CE 612	Advanced Concrete Technology	3 - 0 - 0 - 6
CE xxx	Elective II	3 - 0 - 0 - 6
CE xxx	Elective III	3 - 0 - 0 - 6
CE xxx	Project Management Laboratory	0 - 0 - 3 - 3
		12 - 0 - 3 - 27

SEMESTER - 3

Course No.	Course Name	L - T - P - C
CE xxx	M Tech Project - I	0 - 0 - 24 - 24
		0 - 0 - 24 - 24

SEMESTER - 4

Course No.	Course Name	L - T - P - C
CE xxx	M Tech Project - II	0 - 0 - 24 - 24
		0 - 0 - 24 - 24

Elective I

Course No.	Course Name	L - T - P - C
CE 601	Numerical Methods	3 - 0 - 0 - 6
CE 602	Optimization Methods	3 - 0 - 0 - 6

Elective II

Course No.	Course Name	L - T - P - C
CE xxx	Project Procurement Systems	3 - 0 - 0 - 6
CE xxx	Quality and Safety Management in Construction	3 - 0 - 0 - 6

Elective III

Course No.	Course Name	L - T - P - C
CE 504	Advanced Structural Design	3 - 0 - 0 - 6
CE 581	Urban Transportation Systems Planning	3 - 0 - 0 - 6
CE 665	Water Distribution and Wastewater	3 - 0 - 0 - 6

	Collection System Design	
CE 525	Solid and Hazardous Waste Management	3 - 0 - 0 - 6
CE 568	Environmental Management	3 - 0 - 0 - 6
CE 625	Transportation System Management	3 - 0 - 0 - 6
CE 629	Public Transportation Systems Planning	3 - 0 - 0 - 6
CE 552	Water Resources Systems Analysis, Planning And Management	3 - 0 - 0 - 6
MA 596	Stochastic Calculus for Finance	3 - 0 - 0 - 6
MA 598	Mathematics of Financial Derivatives	3 - 0 - 0 - 6

CE 541 INFRASTRUCTURE PLANNING (3 0 0 6)

Definitions of infrastructure; Typical infrastructure planning steps; Planning and appraisal of major infrastructure projects; Screening of project ideas; Life cycle analysis; Multi-criteria analysis for comparison of infrastructure alternatives; Procurement strategies; Scheduling and management of planning activities; Economic Analysis – Concepts and Applications, Principles of methodologies for economic analysis of public works, Social welfare function, indifference curves and trade offs, Demand curves and price elasticities; Benefit-cost ratio and internal rate of return; Shadow pricing; Accounting for risk and uncertainty; Financial Evaluation - Time value of money, Investment criteria, Project cash flows – elements and basic principles of estimation, Financial estimates and projections, Cost of capital, Rate of return; Project risk analysis; Political and social perspectives of infrastructure planning; Case studies.

Texts:

- 1 A. S. Goodman and M. Hastak, *Infrastructure planning handbook: Planning, engineering, and economics*, McGraw-Hill, New York, 2006.
- 2 J. Parkin and D. Sharma, *Infrastructure planning*, Thomas Telford, London, 1999.

References:

- 1 P. Chandra, *Projects: Planning, analysis, selection, financing, implementation, and review*, Tata McGraw-Hill, New Delhi, 2009.
- 2 J. D. Finnerty, *Project financing - Asset-based financial engineering*, John Wiley & Sons, New York, 1996.
- 3 A. S. Goodman and M. Hastak, *Infrastructure planning handbook: Planning, engineering, and economics*, McGraw-Hill, New York, 2006.
- 4 J. Parkin and D. Sharma, *Infrastructure planning*, Thomas Telford, London, 1999.
- 5 L. Squire and H. G. van der Tak, *Economic analysis of projects*, John Hopkins University Press, London, 1975.
- 6 T. J. Webster, *Managerial economics: Theory and practices*, Elsevier, New Delhi, 2003.

CE 542 PROJECT MANAGEMENT IN CONSTRUCTION (3 0 0 6)

Introduction to project management processes - Initiating, Planning, Executing, Controlling, and Closing processes; Project Integration Management - Project plan development, Project plan execution, and Overall change control; Project Scope Management - Initiation, Scope planning, Scope definition, Scope verification, and Scope change control; Project Time Management - Activity definition - work breakdown structure, Activity sequencing – scheduling logic, precedence diagramming method, arrow diagramming method, Activity duration estimation, Schedule development and analysis - critical path method, program evaluation and review technique, production curves, line-of-balance method, Duration compression, Resource constrained scheduling, Schedule control; Project Cost

Management - Resource planning, Cost estimating, Cost budgeting, and Cost control – earned value method; Project Resource Management - Resource aggregation, Resource leveling – method of moments, double moments, Resource allocation; Time-cost Tradeoff; Project Quality Management - Quality planning, Quality assurance, and Quality control; Project Risk Management - Risk identification, Risk quantification, Risk response development and control; Project Procurement Management - Procurement planning, Solicitation planning, Solicitation, Source selection, Contract administration, and Contract close-out; Material Management; Life-cycle Costing; Value Management; Knowledge Management.

Texts:

- 1 T. Hegazy, *Computer-based construction project management*, Prentice Hall, New Jersey, 2002.
- 2 S. M. Levy, *Project management in construction*, 5th ed., McGraw Hill, New York, 2007.

References:

- 1 PMI, *A guide to the project management body of knowledge*, 3rd ed., Project Management Institute, Pennsylvania, 1996.
- 2 M. Mawdesley, W. Askew and M. O'Reilly, *Planning and controlling construction projects*, Addison Wesley Longman Limited, Essex, 1997.
- 3 J. Kelly, S. Male and D. Graham, *Value management of construction projects*, Blackwell Publishing, Oxford, 2003.

CE 543 CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT (3 0 0 6)

Planning Process for Equipment and Methods; Cost of Owning and Operating Construction Equipment - Ownership cost, Depreciation, Operating cost, and Ownership and operating costs calculation methods; Equipment Life and Replacement Procedures - Physical, profit and economic life, Replacement analysis; Engineering Fundamentals of Moving Earth - Rolling resistance, Effect of grade on tractive effort, Effect of altitude on performance of IC engines; Earthmoving, Excavating, and Lifting Equipment Selection - Bulldozers, Front-end Loaders, Scrapers, Trucks, Excavators, Backhoes, Front shovels, Cranes, and Forklifts; Piles and Pile-Driving Equipment; Production of Crushed-stone Aggregate; Concreting Equipment; Asphalt Mix Production and Placement - Asphalt Plants, and Paving Equipment; Estimating and Optimizing Construction Equipment System Productivity - Peurifoy's method of optimizing productivity, Phelps' Method, Optimizing hauling system based on loading facility; Estimation of Equipment Productivity - Mathematical models, Simulations; Scheduling Equipment-Intensive Horizontal Construction Projects - Linear scheduling method, Precedence diagramming method, Developing equipment resource packages; Scheduling Lifting Equipment for Vertical Construction; Equipment Financing Decision - Financing methods, Rental and lease contract considerations.

Texts:

- 1 D. G. Gransberg, C. M. Popescu and R. C. Ryan, *Construction equipment management for engineers, estimators, and owners*, Taylor & Francis, New York, 2006.
- 2 R. L. Peurifoy, C. J. Schexnayder, A. Shapira and R. Schmitt, *Construction planning, equipment, and methods*, 8th ed., McGraw Hill, New York, 2010.

References:

- 1 D. A. Day and N. B. H. Benjamin, *Construction equipment guide*, 2nd ed., Wiley, New Jersey, 1991.

- 2 F. Harris, *Modern construction and ground engineering equipment and methods*, 2nd ed., Longman, London, 1994.
- 3 J. Singh, *Heavy construction - planning, equipment and methods*, 3rd ed., CRC Press, 2009.

CE 509 PROJECT PROCUREMENT SYSTEMS (3 0 0 6)

Introduction to procurement systems; Common Variants of Main Procurement Systems; Separated Procurement Systems; Integrated Procurement Systems; Management-Oriented Procurement Systems - Management contracting, Construction management; Design and manage; Discretionary Procurement Systems; Project partnering; Strategic partnering; Project Alliancing; Relational Contracting; Contract Administration; Contract Management; Organising the Project Procurement Process; Organisational Design; Emerging Issues in Procurement Systems - Cultural issues, e-Business; Selection of Procurement Systems; Case Studies on Procurement Systems of Parastatal Entities.

Texts/References

- 1 J. W. E. Masterman, *An introduction to building procurement systems*, Taylor & Francis, London, 2002.
- 2 D. Walker and K. Hampson, *Procurement strategies - A relationship-based approach*, Blackwell Publishing, Oxford, 2003.
- 3 S. Rowlinson and P. McDermott, *Procurement systems A guide to best practice in construction*, E&FN Spon, London, 1999.
- 4 D. Walker and S. Rowlinson, *Procurement systems - A cross-industry project management perspective*, Spon, London, 2008.

CE 510 QUALITY AND SAFETY MANAGEMENT IN CONSTRUCTION (3 0 0 6)

Introduction to quality; Importance of quality; Quality transition - quality control and inspection, quality assurance, total quality management; Evolution of quality management; Planning and control of quality during design of structures; Tools and techniques for quality management; Inspection of materials and machinery; Quality assurance in construction; Systems quality management; Quality standards/codes in design and construction; (ISO:9000); Total quality management (TQM) - principles, tools and techniques. Introduction to safety; Safety and health programs in construction industry; Planning for safety provisions; Analysis of construction hazards and accidents; Construction hazards and safety guidelines; Prevention techniques for construction accidents; Site management with regard to safety recommendations; Training for safety awareness and implementation; Construction safety and health manual.

Texts/References:

- 1 B. G. Dale, *Managing quality*, 4th ed., Blackwell Publishing, Oxford, 2003.
- 2 C. D. Reese and J. V. Eidson, *Handbook of OSHA construction safety and health*, 2nd ed., CRC Press, Boca Raton, 2006.
- 3 F. Harris, R. McCaffer and F. Edum-Fotwe, *Modern construction management*, 6th ed., Blackwell Publishing, Oxford, 2006.
- 4 K. Knutson, C. J. Schexnayder, C. M. Fiori and R. Mayo, *Construction management fundamentals*, 2nd ed., McGraw Hill, New York, 2008.
- 5 A. S. J. Holt, *Principles of construction safety*, Blackwell Publishing, Oxford, 2008.

CE 544 PROJECT MANAGEMENT LABORATORY (0 0 3 3)

Management of infrastructure projects using project management software packages such as MS Project 2007 and Primavera Project Planner - Project estimation, project planning, project scheduling, network analysis, project time reduction and optimization, resource leveling, project time, cost and finance management.

Texts/References:

- 1 P. Harris, *Planning and scheduling using Microsoft Office Project 2007*, Eastwood Harris Pty Ltd, Victoria, 2007.
- 2 P. Harris, *Project planning and control using Primavera P6*, Eastwood Harris Pty Ltd, Victoria, 2008.
- 3 E. Marmel, *Microsoft project 2007 bible*, Wiley Publishing, Indianapolis, 2007.