Sardar Patel College of Engineering, Andheri (West), Mumbai
400058 Year: 2024-25

M. Tech. in Civil Engineering with Construction Management

Course Contents
Academic Year 2024-25

Contents

M.Tech. in Civil Engineering with Construction Management

SEMESTER I

PC-MTCM101 Construction Organisation and Safety Management

Course Code	Course Name
PC-MTCM101	Construction Organisation and Safety Management

Course pre-requisites	Construction Management

Course Objectives

The objectives of this course are

1. Discuss principles of management and its functions in construction organization.
2. Knowledge of organization's working procedures and organizational developments and group decision making.
3. Identify quality of team leader and qualities of project leader.

Course Outcomes

Upon successful completion of the course, students should be able

1. To apply fundamentals of management to utilize functions of management in construction. Like Demonstrate leadership qualities by implementing construction project processes with control.
2. Implement planning strategies and policies.
3. Carry out organization and execute work in group in an organization

Course Content

Module No.	*Details*	*Hrs.*
1	Management: Need, what is it, systems approach, and emergence of management thought, Theory by Fredrick Taylor, Henry Fayol, emergence of behavioral sciences, and that of the modern management thought.	04
2	Construction Management: Planning: Planning process, objectives, strategies and policies, making planning effective, and Organizing; Need and objectives, nature and purpose, types of construction organizations, Staffing: Need and objectives, Nature and purpose, selection, appraisal. Leading; Need and objectives, Managing and human factor, motivation, leadership, team development, communication, managing conflicts, qualities of project manager; Controlling Need and objectives, Process of controlling,	06
3	Work study Definition, Objective, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams. Work Measurement: Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating. Activity sampling, time-lapse photography technique, Analytical production studies	05

4	Construction Safety Management, role & importance of safety management – Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports.	05
5	Safety in construction operations – Accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety protocols. Occupational diseases and hazards. Safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety while using scaffolding and working platforms. Safety while using electrical appliances. Managing fire, electricity and Explosives	05
6	Various safety equipment and gear used on site, safety measures while handling machinery, tools and equipment's. First aid on site. Labour laws, legal requirement and cost aspects of accidents on site.	05
7	Study of safety policies, methods, equipment and training provided on any ISO approved construction company, safety audits and OSHA guidelines, international labour standard on occupational safety and health	06

Text Books

1. Koontz, O'Donnell &Weihrich (2010); "Management", Mcgraw Hill. ISBN-13: 9780070144958. 464p.
2. Chinowsky, Paul S. & Songer, Anthony D. (2011) "Organization Management in Construction". Routledge. ISBN-13: 978-0415572613. 216p.
3. Sears, Keoki S, (2008) "Construction Project Management: A Practical Guide to Field Construction Management". Wiley. ASIN: B00HQ1CNE2.
4. Frank Harris (2013); "Modern Construction Management", Ronald Mccaffer Wiley Blackwell Publications. ISBN-13: 978-0470672174. 572p.
5. Wagner.Harvey M (1975) "Principles of Management Science" Prentice Hall College Div. ISBN-13: 978-0137095353. 612p.
6. Snell, Scott & Bohlander George (2009) "Managing Human Resources" South-Western Cengage Learning; ISBN-13: 978-0324593310. 864p.
7. Dessler, Gary (2008) "Human Resource Management" Prentice Hall. ISBN-13: 978-0131746176. 801p.
8. Dharwadkar P. P (1992); "Management In Construction Industry" Oxford & IBH

Luthans.
9. V. J. Davies, K. Tomasin (1996); "Construction Safety Handbook", Thomas Telford, London. Isbn-13: 9780727725196. 303p.
1. PSG Design Data Book, PSG College, Coimbatore (2012)

Reference Books

1. Construction Safety Manual Published By National Safety Commission of India.
2. "Safety Management in Construction Industry" – A Manual for Project Managers. Nicmar Mumbai.
3. "IS For Safety In Construction – Bureau Of Indian Standards.
4. Girimaldi and Simonds (1989); "Safety management", AITBS, New Delhi. ISBN: 9780939874989.651p.
5. Stranks, Jeremy (2010) "Health and Safety at Work: An Essential Guide for Managers", Kogan Page Publishers. ISBN 13: 9780749461201. 352p.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PC-MTCM102 Applied Statistics and Quantitative Techniques

Course Code	Course Name
PC-MTCM102	Applied Statistics and Quantitative Techniques

Course pre-requisites	Construction Management

Course Objectives
The objectives of this course are 1. Describe probability theory and Different methods of statistics. 2. Identify different methods of data collections with its analysis as well as decision making. 3. Discuss the application of linear programming problem and transportation problem and simulation in construction industry.
Course Outcomes
Upon successful completion of the course, students should be able 1. Practice different methods of statistics, probability distribution and its applications in civil engineering, different methods of data collection and presentation. 2. Make decisions and carry out simulation of various systems. 3. Implement the concept of linear Programming Problem and Transportation Problem in getting the optimum solution for civil engineering problem.

Course Content

Module No.	*Details*	*Hrs.*
1	Review of basic statistics, probability and Probability Distributions: Theoretical, binomial, poisson, normal, exponential, hypergeometric, uniform. Statistical Quality Control, Total cost & Trade off analysis	08
2	Sampling and Sampling Distributions: Probability and non-probability samples, sampling and non-sampling errors, sample size, sampling distributions : t, F and x2 distributions	05
3	Hypothesis Testing: Type I and II error, testing of mean, proportion, tests for equality of mean and variances of two populations, confidence interval, 2 test for goodness of fit, ANOVA (one way classification), Non parametric tests : sign test, U test	05
4	Correlation and Regression: Karl Pearson's and Rank Correlation coefficient, simple linear regression: least squares method. Multiple Regression Analysis. Regression problem, use of excel for solving.	05
5	Simulation: Random number generation. Monte Carlo method, Application of Design of Experiments(DOE) and Kappa Coefficient in construction industry	04
6	Transportation, Assignment and Transshipment Problems	03
7	Linear Programming: Graphical solution, simplex method, dual,	

	Sensitivity analysis, use of MS excel for solving LPP.	06

Term Work

Term work shall comprise of

1. Report on assignments including problems based on the above syllabus shall be submitted as term work.
2. One assignment on each module is to be submitted.
3. Reports of assignments : 25 points

Text Books

1. Shrivastava, Shenoy& Sharma (1989); "Quantitative Techniques for Managerial Decisions" New Age International. ISBN-13: 9788122401899. 941p.
2. Kothari C R (2004); "Research Methodology: Methods and Techniques", New Age International. ISBN-13: 978-8122415223. 401p.
3. Goode W J &Hatt P K (2006) "Methods in Social Research" Surjeet Publication. 386p.

Reference Books

1. Quantitative Technique for Managerial decision by L.C. Jhamb
2. D.S. Hira and Gupta "Operation Research", S.Chand Publication

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PC-MTCM103: Research Methodology and IPR

Course Code	Course Name
PC-MTCM103	Research Methodology and IPR

Course pre-requisites	

Course Objectives
1. Understand research problem formulation. 2. Analyze research related information 3. Follow research ethics
Course Outcomes
Understand that today's world is controlled by Computer, Information 1. Technology, but tomorrow world will be ruled by ideas, concept, and creativity. 2. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular. 3. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

Course Content

Module No.	*Details*	*Hrs.*
1	**Meaning of research problem**. Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research Problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	05
2	**Effective literature studies approaches, analysis** Plagiarism, Research ethics,.	05
3	**Effective technical writing, how to write report, Paper** Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	05
4	**Nature of Intellectual Property** Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, Patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	05
5	**Patent Rights:** Scope of Patent Rights. Licensing and transfer of	

	technology. Patent information and databases. Geographical Indications. **New Developments in IPR** Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	05

Term Work

Term work shall comprise of

- Report on assignments including problems based on the above syllabus shall be submitted as term work.
- One assignment on each module is to be submitted.

Reports of assignments : 25 points

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.

Reference Books

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
2. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Sr. No.	Examination	Module
1	T-I	1 and 2
2	T-II	3 and 4
3	End Sem	1 to 5

PE-MTCM101 Building Services and Maintenance

Course Code	Course Name
PE-MTCM101	Programme Elective – I : Building Services and Maintenance

Course pre-requisites	

Course Objectives

The objectives of this course are

1. To discuss the concept of various machineries like lift, escalators, vibrators, concrete mixers etc.
2. To explain utility services in building like pluming system, electrical system, fire safty installation and rainwater harvesting system etc.

Course Outcomes

Upon successful completion of the course, students should be able

1. To implement installation of utility services.
2. To identify drawback if all service lines are not install properly or used any faulty materials.
3. To carry out water audit.

Course Content

Module No.	*Details*	*Hrs.*
1	Machineries: Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity -Hot Water Boilers – Pumps	06
2	Plumbing Systems in Building: Plumbing services:-Water distribution system-Material for service pipesService connection-size of service pipe-Water meter-Valves-Storage tanksDrainage system:-Pipe and traps-Sanitary fittings-system of plumbingHouse drainage plans-Septic tank-Soak pit	05
3	Electrical Systems& Illumination Design in Buildings: Electrical Systems in Buildings: Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations Principles of Illumination Design: Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals	06

	and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.	
4	Refrigeration Principles & Applications: Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems	06
5	Fire Safety Installation: Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers	05
6	Rain Water Harvesting: Water Audit of India, Concept of rain water harvesting, Methodologies for Percolation/ recharge bore pit, Percolation/ recharge bore well, Percolation/ recharge well cum bore pit, Harvesting rooftop rainwater, Harvesting driveway runoff. National water harvesters network (NWHN). Some case studies.	04
7	Introduction to Green Building: Need for a green building, planning and design of green buildings, obstacles, Materials used in green building technology, Rating System (According to LEED-INDIA)	04

Text Books

1. Heat Pumps and Electric Heating: E.R.Ambrose, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
4. The Lighting of buildings: R.G.Hopkinson and J.D.Kay, Faber and Faber, London, 1969.
5. Air-conditioning and Refrigeration: William H.Severns and Julian R.Fellows, John Wiley and Sons, London, 1988.
6. Air-conditioning and Energy Conservation: A.F.C. Sherratt, the Architectural Press, London, 1980.
7. National Building Code.
8. Building Construction: Dr. B.C. Punmia, Ashol K Jain, A.K Jain
9. Construction Engineering and Management: S. SeetharamanUmeshPublicatins, Delhi.

10. Water supply and Sanitory Installations: A. C. Panchdhari New age international publication, Delhi
11. Fire Safety in Building: V. K. Jain, New age international publication, Delhi

Reference Books

1. Green remodeling: David Johnston.
2. Green Building , Project Planning and Cost Estimation: R.S.Means
3. LEED – INDIA (Abridged Reference guide for Core and Shell, Version 1.0).

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM102 Construction Materials

Course Code	Course Name
PE-MTCM102	Elective – I : Construction Materials

Course pre-requisites	

Course Objectives

The objectives of this course are

1. Describe commonly used building materials
2. Develop knowledge of material science and behaviour of various building materials used in.
3. Discuss and understand the properties of building Materials.

Course Outcomes

Upon successful completion of the course, students should be able

1. To familiarize students about the characteristics of construction materials used in civil engineering.
2. To select eco-friendly and sustainable building materials.

Course Content

Module No.	*Details*	*Hrs.*
1	Various construction chemicals/admixtures.	06
2	Flyash and its use in concrete , Silica fume concrete	05
3	Fibre Reinforced plastics and concrete, Smart materials	04
4	Self compacting concrete, High performance concrete; composite decking and hollow core slab	05
5	Materials used in nuclear-containment structures	06
6	Glenium Concrete, Self-healing concrete, Photo catalytic cement, glazed bricks	04
7	Crumb modified bitumen Rubber	06

Text Books

1. Neville (2008);" Concrete Technology", Pearson Education India. ISBN: 9788131705360.452p.
2. M.S.Shetty (2005);" Concrete Technology",ISBN:9788121900034.624p.
3. Ghosh (1991);" Building Materials",ISBN:9788185522005.494p.
4. New Building Materials and Construction World magazine

Reference Books

1. Civil Engineering and Construction Review magazine
2. Construction Materials Reference Book (2018), edited by David Doran, Bob Cather, Routledge Publications, London and Newyork, second edition.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM103** Accounting and Finance Management

Course Code	Course Name
PE-MTCM103**	Elective I : Accounting and Finance Management(Online Course)

Course pre-requisites	

Course Objectives
The objectives of this course are 1. To explain the basic concept of accounting mechanics with financial statements. 2. To summarize use of policies of project finance & financial analysis. 3. To report long term investment decisions 4. To describe the management of current assets

Course Outcomes
Upon successful completion of the course, students should be able 1. Practice basic accounting mechanics 2. Carry out financial statement 3. Implement various techniques of financial analysis 4. Utilize various policies of project finance & investment decisions and appraise the management of current assets

Course Content

Module No.	*Details*	*Hrs.*
1	**Basic accounting mechanics** Generally accepted accounting principles, books of original entry	03
2	**Preparation of financial statements** Income statement, balance sheet, preparing bills, issues.	04
3	**Techniques of financial analysis** Statement of changes in financial position (working capital / cash flow / total resources basis)Ratio analysis, internal rate of IIR, net present value.	06
4	**Project financing** Means, norms, and policies of financial institutions, sources of finance, equity, debentures, debit, bond, fixed deposit, mega project finance policy.	06
5	**Long term investment decisions** Cash flow estimates, evaluating techniques, alternative selection, basic concepts of analysis of risk and uncertainty, cost of capital, lease financing, selection from alternative options, management of inflations.	06

6	**Management of current assets-I** Planning, financing and control of working capital, cash flow statement.	06
7	**Management of current assets-II** Management of cash, receivables management, inventory management	05

Text Books
1. S. K. Bhattacharyya, John Dearden (1996); "Accounting for Management: Text and Cases" South Asia Books. ISBN 13: 9780706928976. 2. Prasanna Chandra (2011); "Financial Management", Tata McGraw-Hill Education. ISBN 13: 9780071078405. 1026p.
Reference Books
1. Construction Safety Manual Published By National Safety Commission of India. "Safety 2. **Handbook of Finance, Financial Markets and Instruments(2008),** edited by Frank J. Fabozzi, Volume (I), John Wiley and sons, New Jersy.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM111 Management of Infrastructure Services

Course Code	Course Name
PE-MTCM111	Elective – II : Management of Infrastructure Services

Course pre-requisites	

Course Objectives
The objectives of this course are 1. To study the necessity of infrastructure & its management 2. To understand various concepts of infrastructure planning and management.

Course Outcomes
Upon successful completion of the course, students should be able 1. Design integrated framework for infrastructure planning and management. 2. Analyse the strategies for Infrastructure Project implementation. 3. Perform Infrastructure modelling and Life Cycle Analysis Techniques.

Course Content

Module No.	*Details*	*Hrs.*
1	**Infrastructure management** Need and concept, expected performance, survey and Scheme of evaluation of distresses, inspection checklists, organization for rehabilitation, policies, funding	04
2	**Concept of infrastructure upkeep**	06
3	**Buildings** Post occupancy Scheme of evaluation of buildings, deformation and common defects in buildings, restoration & rehabilitation measures	05
4	**Pipelines (water/ sewage/ air/ gas)** Purpose and methods of Scheme of evaluation, Scheme of evaluation of physical condition, methods of rehabilitation	05
5	**Pavements (roadways / runways)** Scheme of evaluation and performance surveys, distress Scheme of evaluation, methods of resurfacing, overlays, restoring and rehabilitation, up-gradation and maintenance of permanent way	05
6	**Bridges,** Inspection and reporting methods, rehabilitation measures,	05
7	**Ports & Harbours** Inspection and reporting methods, Maintenance of ports, port	06

	buildings, and services.	

Text Books
1. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988). 2. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar,(1994). 3. Hudson, Haas, Uddin, Infrastructure management: integrating design, 4. construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).
Reference Books
1. Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc. 2. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment, Proceedings of a Conference Held in June (1990). 3. World Development Report 1994: Infrastructure for Development (1994). 4. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September (2000).

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM112 Advanced Construction Techniques

Course Code	Course Name
PE-MTCM112	Elective 1I : Advanced Construction Techniques

Course pre-requisites	Construction Management

Course Objectives
The objectives of this course are 1. To introduce various advanced construction techniques currently used in the industry 2. To make students aware of state of the art construction practices with the help of case studies
Course Outcomes
Upon successful completion of the course, students should be 1. Able to select and apply suitable advanced construction techniques for a given project. 2. Motivated to learn about emerging trends such as sustainable construction and pre-engineered buildings. 3. Aware of current problems and innovative solutions offered by the industry through case studies.

Course Content

Module No.	*Details*	*Hrs.*
1	Review of subsurface soil explorations and geophysical methods for expansive soils, landslide hazards, liquefaction of soils, karst topography. Soil stabilization: mechanical, thermal and chemical.	05
2	Excavation and Tunneling: trenching machines, blasting method, dewatering methods. Tunnel ventilation, lighting and drainage, cut and cover, rock tunneling, shield tunneling in free air, compressed air tunneling, linings, machine tunneling, supporting systems, micro tunneling.	06
3	Construction methods for drilled shafts, caissons, cofferdams, Shores, needles, grillages	06
4	Special topics of concrete construction: Formwork: types, design criteria, patented systems. Fabrication of precast and pre-stressed components Pre-stressing: Plants, Equipment for Pre-stressed Construction, Different types of Pre-stressing. Pumped and sprayed concrete, roller compacted, self-compacted, fiber compacted concrete.	06
5	Advanced Pavement Construction Techniques: Pavement Construction using Bitumen, Hot mix plant, Concrete Road Construction, Fiber Reinforced Pavement Construction, Low Cost Road Construction Techniques.	05
6	Sustainable construction: Building materials from Agricultural &	05

	Industrial wastes. Recycled concrete and aggregates Pre-engineered Buildings: need, type, advantages and disadvantages.	
7	Construction of Transit Camps and 3-D Printing; Case study of heavy structures/construction projects like thermal/hydro / nuclear power plants/refineries, etc.	03

Text Books
1. Jonathan Ricketts, M. Loftin, Frederick Merritt (2004); "Standard Handbook for Civil Engineers", Mcgraw Hill. ISBN-13: 978-0071433372. 1600p. 2. Waddell (1974); "Concrete Construction Handbook", Mcgraw Hill 3. J.R. Illingworth (2002);"Construction Methods and Planning" CRC Press. ISBN 13: 9780203478578. 440p. 4. Varma Mahesh (1975); "Construction Equipment, Its Planning & Application" Metropolitan. 539p.
Reference Books
1. Relevant Journal papers and International Conference papers 2. Roger Greeno , R. Chudley), Mike Hurst , Simon Topliss (2012) Advanced Construction Technology, 5th edition, Pearson Education.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM113 Construction Marketing

Course Code	Course Name
PE-MTCM113	Elective – II : Construction Marketing

Course pre-requisites	

Course Objectives

The objectives of this course are

1. Students will learn the components and construction of a strategic marketing.
2. Explore potential marketing areas in the building construction industry

Course Outcomes

Upon successful completion of the course, students should be able

1. To identify core concepts of marketing and the rile of marketing in society.
2. To collect, process, and analyze consumer and market data to make informed decisions.
3. To create branding and integrated marketing communications plans that include value propositions.

Course Content

Module No.	*Details*	*Hrs.*
1	**Marketing environment:** impact of internal and external environment, socio-economic, demographic, political, technological and legal environment, nature and impact of competition, marketing strategy	04
2	**Basics of marketing:** Features of marketing of consumer goods, industrial products and services, product and marketing, marketing organization structures, societal role of marketing	06
3	**Marketing projects I:** Characteristics of construction projects, sources of information, pre-qualification documents, bid preparation – estimating, provision for overheads and profit, bidding models, bidding strategy, pre-bid meetings, negotiation,	05
4	**Marketing projects II:** Legal aspects, impact of joint ventures, collaborations and alliances, impact of globalization and privatization, strategies for project export.	05
5	**Marketing real estate:** Characteristics of real estate, demand and supply relationship, segmentation, product mix, pricing strategies, advertising strategies, legal aspects	05
6	**Marketing products for construction:** Characteristics of construction materials and equipment, strategies for marketing of materials and equipment for construction, demand	05

	surveys, advertising strategies, communication, exhibitions and product demonstrations,	
7	Pricing strategies, financing arrangements for marketing products for construction	06

Text Books
1. Christopher Peerce and Paul Smith (2003), Construction Business Development: Meeting New Challenges, Seeking Opportunities, A Butterworth-Heinemann publisher.
Reference Books
1. Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM121 Repair, Rehabilitation and Retrofitting Techniques

Course Code	Course Name
PE-MTCM121	Elective – III : Repair, Rehabilitation and Retrofitting Techniques

Course pre-requisites	

Course Objectives

1. To understand need for repair and rehabilitation.
2. To develop clear understanding of concepts, and practical knowledge of modern Civil Engineering techniques.
3. To encourage students and faculty to interact with industry, alumni and other reputed institutes for purpose of better understanding of industry requirements and different materials used.
4. To deal with social, environmental and economic issues when applying various techniques.

Course Outcomes

At the end of the course the student shall be able to develop collaborative skills to work in a team/group and technical skills to

1. Select and apply various repair techniques and appropriate materials as per the requirement of the problem.
2. Select and apply various structural strengthening techniques and appropriate materials.
3. Select and apply appropriate materials for repair and restoration of heritage structures.
4. Prepare protection & maintenance schedule against environmental distress

Course Content

Module No.	*Details*	*Hrs.*
1	Importance of rehabilitation as a part of construction engineering.	05
2	Rehabilitation studies of buildings, underground construction, bridges, streets and highways, sewage treatment plants – masonry work, R.C.C. works, steel structures- types of distress.	05
3	Numerical condition surveys for foundation, structural and functional deterioration, design criteria, materials and techniques.	06
4	Predictive performance models, evaluating alternatives based on technical, commercial, management, financial feasibilities, data collection and database management, maintenance of rehabilitated structures.	08
5	Procedure adopted by BIFR (Board of Industrial and Financial Reconstruction).	07
6	Earthquake damages of buildings,their retrofitting, restoration, effects of earthquakes, response of buildings to earthquake motion,	03

	factors related to building damages due to earthquake.	
7	Methods of seismic retrofitting, restoration of buildings.	02

Text / Reference Books
1.R. Dodge Woodson (2009);" Concrete Structures: Protection, Repair and Rehabilitation", ISBN: 9780080949819. 280p.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM122 Appraisal & Implementation of Infrastructure Projects

Course Code	Course Name
PE-MTCM122	Elective – III: Appraisal & Implementation of Infrastructure Projects

Course pre-requisites	

Course Objectives
student will be able to 1. To discuss about Infrastructure project and their feasibility. 2. To explain appraisal of construction project. 3. To describe the need of financial and environmental appraisal of project. 4. To outline project audit, financing and its implementation.
Course Outcomes
1. To carry out construction project appraisal. 2. To evaluate construction economic and environmental analysis. 3. To practice various method for implementation of construction project including arrangement of finance.

Course Content

Module No.	*Details*	*Hrs.*
1	Components of Infrastructure, Infrastructure scenario in India, Key issues sector wise, Urban Infrastructure, Rural infrastructure, characteristics of construction project, stakeholders in Infrastructure projects, Phases of infrastructure project	04
2	Project Feasibility Project management cycle, Detailed Project report, project formulation project implementation, Agencies involved in implementation, methods of implementation like Build, operate and transfer (BOT) method and its variants like BOO, BOOT, BOLT etc, SWOT analysis of project.	04
3	Project Appraisal Introduction, Need of appraisal, steps of appraisal Market appraisal, Demand analysis, forecasting demand, sources of information, market survey, uncertainties in demand forecasting Technical appraisal Location, land, buildings, technology and its appropriateness, size of plant, plant and machinery, raw materials, energy requirements, water supply, effluent disposal Management appraisal	08
4	Financial and Environmental Appraisal of project Break-even analysis, financial projections, financial appraisal tools: payback period, accounting rate of return, net present value,	08

	internal rate of return, benefit cost ratio, cost of capital, risk analysis, social cost benefit analysis. Guidelines for environmental Appraisal for infrastructure project	
5	Project Audit Project budget and schedule, causes of project failure, reason for audit, Construction Contract audit and phases of project audit.	08
6	Project financing Norms and policies of financial institutions, Types of financing, sources (local and international),Cash flows by financial institutions, planning commission/Niti Aayog, various issues in financing	04
7	Road and bridge Infrastructure Development Issues and challenges in construction and maintenance of road and bridge Infrastructure, sustainable development of Infrastructure, role of PPP in road and bridge infrastructure development.	04

Text / Reference Books
1.Project Preparation, Appraisal, Budgeting, and Implementation: Prasanna Chandra, Tata McGraw Hill.

Sr. No.	**Examination**	**Module**
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM123 Management of Housing Projects

Course Code	Course Name
PE-MTCM123	Elective –III : Management of Housing Projects

Course pre-requisites	

Course Objectives
1. To make them understand the concepts of Project Management for planning to execution of projects. 2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
Course Outcomes
At the end of the course, 1. The students shall have acquired knowledge of the process involved in addressing a design problem with emphasis on site planning. 2. Can address socio-cultural, and economic issues connected with. Integrated approach to design.

Course Content

Module No.	*Details*	*Hrs.*
1	**National housing policy** Need and importance of housing, role of various state and national level agencies, local bodies etc., rural and urban housing, systems approach to housing and urban planning	06
2	**Managing technology** New developments: materials, construction techniques, low cost housing, mass housing, industrialized housing, appropriate technology	08
3	**Planning** Pre-execution phase, project phase and post-execution phase	04
4	**Management of building services** Water supply, waste disposal, lifts, HVAC systems	06
5	**Maintenance of buildings** Need and importance, organization and management	05
6	**Estate management** Policy and organization	04
7	Introduction to RERA, Government policies for slum Rehabilitation	03

Text / Reference Books
Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PC-MTCM151 Advanced Materials Testing Lab

Course Code	Course Name
PC-MTCM151	Advanced Materials Testing Lab

Course pre-requisites	

Course Objectives

Course Objective: Students will learn

1. To understand the type of tests conducted to measure distress in the buildings.
2. To educate the student about the damage identification and repairing techniques.

Course Outcomes

After completion of course, student will be able to :

1. Determine the degree of deterioration of concrete structures.
2. Suggest the remedial measures to strengthen the structural elements.
3. Carry out modern tests to evaluate concrete quality.

Expt. No.	*Details*
	Course Content: Laboratory work to includes Experimental work on 1. Carbonation test 2. Rebound Hammer Test 3. Half Cell Potentiometeric Test 4. Core Test 5. Ultrasonic Pulse Velocity test 6. Chemical Analysis of concrete 7. Retrofitting Techniques- (Materials and methods) 8. static and dynamic plate bearing tests 9. Dynamic and integrity test on concrete piles

Lab Work

Lab work shall comprise of

at least seven practical's performed from the list given above : 50 points

1. Neha Jamwal and M L Gambhir (2007)Building and Construction Materials: Testing and Quality Control (Lab Manual Series
2. Bhargava A K (2008) mechanical Behaviour and Testing of Materials.

Reference Books

1. Relevant Indian/American standards for testing of materials

SE-MTCM152 Geo-Informatics Lab

Course Code	Course Name
SE-MTCM152	Geo-Informatics Lab

Course pre-requisites	

Course Objectives

Course Objective: Students will learn

1. About GIS technology, various softwares of GIS, and their utility.
2. To apply engineering knowledge with GIS technology to conduct small projects.

Course Outcomes

After completion of course, student will be able to :

1. Describe spatial and non-spatial database
2. Acquire and extract various types of spatial data from Global positioning System (GPS), satellite imageries, printed maps, and online sources.
3. Develop spatial and thematic maps for analysis, decision-making and display it in various forms

Course Content

Expt. No.	*Details*

Laboratory work to include at least TEN practicals performed from the list given below:

1. Installation of GIS software and getting familiarized with GIS menu and Tools.
2. Map Projections and Map digitization.
3. Georeferencing.
4. Creating Vector and Creating Raster data / data layers.
5. Creating attribute table.
6. Measurements; length and area.
7. Data viewing based on Single Symbol, Graduated Symbol.
8. Data viewing on Continuous color and unique value.
9. Labeling the features.
10. Selection tool and Geo-processing tool (Buffer, Clip, intersect and difference).
11. Coordinate capture – to save in notepad.
12. Joining layers based on common field.
13. Data conversion (raster to vector), polygon to polyline.
14. Add Graphic overlay to a vector layer.

Import and export data and Map Layout

Lab Work

Lab work shall comprise of
at least TEN practical's performed from the list given above : 50 points

IK-MTCM101 Constitution of India (Indian Knowledge System Course)

Course Code	Course Name
IK-MTCM101	**Constitution of India**

Course pre-requisites	

Course Objectives
Students will be able to: 1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. 2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism. 3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution
Course Outcomes
Students will be able to: 1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics. 2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. 3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. 4. Discuss the passage of the Hindu Code Bill of 1956

Course Content

Module No.	*Details*	*Hrs.*
1	➢ History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)	5
2	➢ Philosophy of the Indian Constitution: Preamble Salient Features	5
3	➢ Contours of Constitutional Rights & Duties: ➢ Fundamental Rights ➢ Right to Equality ➢ Right to Freedom ➢ Right against Exploitation ➢ Right to Freedom of Religion ➢ Cultural and Educational Rights ➢ Right to Constitutional Remedies ➢ Directive Principles of State Policy ➢ Fundamental Duties.	5
4	➢ Organs of Governance: Model Curriculum of Engineering & Technology PG Courses [Volume -II][194] ➢ Parliament ➢ Composition ➢ Qualifications and Disqualifications ➢ Powers and Functions ➢ Executive	5

	➢ President ➢ Governor ➢ Council of Ministers ➢ Judiciary, Appointment and Transfer of Judges, Qualifications ➢ Powers and Functions	
5	➢ Local Administration: ➢ District's Administration head: Role and Importance, ➢ Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. ➢ Pachayati raj: Introduction, PRI: Zila Pachayat.	5
6	➢ Elected officials and their roles, CEO Zila Pachayat: Position and role. ➢ Block level: Organizational Hierarchy (Different departments), ➢ Village level: Role of Elected and Appointed officials, ➢ Importance of grass root democracy	5
7	➢ Election Commission:Role and Functioning. ➢ Chief Election Commissioner and Election Commissioners. ➢ State Election Commission: Role and Functioning. ➢ Institute and Bodies for the welfare of SC/ST/OBC and women	6

Reference Books
1. The Constitution of India, 1950 (Bare Act), Government Publication. 2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015. 3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014. 4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Sardar Patel College of Engineering, Andheri (West), Mumbai
400058 Year: 2024-25

M.Tech. in Civil Engineering with Construction

Management

SEMESTER II

PC-MTCM201 Project Monitoring and Control

Course Code	Course Name
PC-MTCM201	Project Monitoring and Control

Course pre-requisites	Construction Management

Course Objectives
1. To describe concept of project monitoring and control. 2. To explain concept of cost and quality management 3. To summarize concept of project safety and management information system
Course Outcomes
1. Carry out project monitoring and control 2. Practice cost and quality management 3. Execute project safety and management information system

Course Content

Module No.	*Details*	*Hrs.*
1	**Scope Management** Definition of Scope Management, Scope variation, Method and process for Scope management, Scope planning and detailing, Scope monitoring and Control, Method Statement	06
2	**Project monitoring** Definition of Project Monitoring and Control, Progress reporting, review meetings, updating plans, formatting progress review report, records to be maintained at site	06
3	**Schedule control** Common causes of schedule delays, measuring productivity, Methods of enhancing productivity, issue in project delays.	06
4	**Cost control** Cost codification, earned value concept, variance analysis, alarm reports, control measures, client and contractor point of view, Introduction to Lean Construction	06
5	**Project Communication and Co-ordination** Need for Communication Management, Methods of communication, Communication Management Plan, Monitoring and Control	03
6	**Quality management** Concept of quality, aspects of quality, quality control and assurance, inspection, preparation of manuals and checklists for different construction, safety and quality works	04
7	**Integrated approach to project control** Need for Integration Management, Methods and Process for integration management, Project management information systems, computer networking, and introduction to related computer software's.	06

Text Books

1. Harold Kerzner, Ph.D., Kerzner (2009); "Project Management" John Wiley & Sons, ISBN 13: 9780470548486.
2. Pilcher R (1994); "Project Cost Control in Construction", John Wiley & Sons. ISBN 13: 9780632036370. 400p.
3. Jack R. Meredith, Samuel J. Mantel, Jr (2011); "Project Management: A Managerial Approach" John Wiley & Sons. ISBN 13: 9780470533024. 600p.
4. Ralph W. King, Roland Hudson (2008); "Construction Hazard & Safety Handbook" Butterworths. ISBN 13: 9780408013475. 477p.
5. Brian Thorpe, Peter Sumner, John M. Duncan (1996); "Quality Assurance in Construction" Gower Press. ISBN 13: 9780566077586. 153p

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PC-MTCM202 Project Appraisal, Planning and Scheduling

Course Code	Course Name
PC-MTCM202	Project Appraisal, Planning and Scheduling

Course pre-requisites	Construction Management

Course Objectives

1. Discuss project preparation, Analysis and Appraisal and Risk analysis with its types, measures & tools for assessment.
2. Identify Value analysis including job plan, function analysis, creative thinking, cost
3. To summarize Modeling, life cycle costing, value engineering and management.
4. To report Project planning and scheduling with reference to scheduling tools like bar Chart and Network techniques such as CPM and PERT.

Course Outcomes

1. Carry out planning, execution and controlling of projects in Civil Engineering with developing capability of preparing project networks
2. Determine time cost relationship by using life cycle costing, value engineering and management.
3. Utilize Project planning and scheduling with reference to scheduling tools like bar Chart and network techniques such as CPM and PERT.

Course Content

Module No.	*Details*	*Hrs.*
1	**Project Preparation, Analysis and Appraisal** Project development cycle, project ideas, preliminary screening Analysis and appraisal: market and demand, technical, financial, economic, ecological	05
2	**Project Planning:** Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data. Application of MS-Project and PrimaVera for planning	05
3	**Project Scheduling** Bar charts, Networks: basic terminology, single and overlapping relationships preparation of CPM networks: activity on link and activity on node representation, analysis of single relationship (finish to start) networks, computation of float values, critical and semi-critical paths, calendaring the events.	05

	PERT: Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion	
4	**Resource Scheduling:** Bar chart, line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling	05
5	**Project Costing and Budgeting** Classification of costs, time cost trade-off in construction projects, Compression and decompression. Preparing budgets, master networks. At least one assignment shall be done using any project planning and scheduling software as part of term work. Introduction of Rivet software in estimation	06
6	**Estimating methods and Appraisal criteria**: parameter, cost capacity factor, cost indices, detailed estimates, provision for escalation, inflation and contingencies Financial appraisal criteria : NPV, BCR, IRR, Urgency, payback period, ARR, Scheme of evaluation of various criteria, investment appraisal in practice	05
7	**Advancement in Project Management** Advance/latest developments in Project Management: Construction digitization, Introduction of Internet of Things in construction industry, Augmented reality (AV), Virtual reality (RV), Scenario Analysis.	05

Term Work

Term work shall comprise of

1. Report on assignments including problems based on the above syllabus shall be submitted as term work.
2. One assignment on each module is to be submitted.
3. Reports of assignments : 25 points

Text / Reference Books

1. Prasanna Chandra (1986); “Projects preparation, appraisal, budgeting & implementation”, Tata McGraw Hill. ISBN-13: 978-0074516287. 543p.
2. Gregory T. Haugan (2002); “Project Planning and scheduling” Management Concepts Inc. ISBN 13: 9781567261363. 102p.
3. Saleh A. Mubarak (2012); “Construction project scheduling and control” John Wiley & Sons. ISBN 13: 9780470919958. 480p.
4. James Lewis (2005); “Project Planning, Scheduling & Control, 4E: A Hands-On Guide to Bringing Projects in on Time and on Budget” McGraw-Hill Companies, Incorporated. . ISBN 13: 9780071460378. 510p.
5.Eric S. Norman, Shelly A. Brotherton, Robert T. Fried (2010); “Work Breakdown Structures: The Foundation for Project Management Excellence” John Wiley & Sons. ISBN 13: 9781118000267. 304p.
6. Project Management Institute (2006); “Practice Standard for Work Breakdown Structures”’ Project Management Institute, ISBN 13: 9781933890135. 111p.
7. Robert B. Harris (1978); “Precedence & arrow networking techniques for construction” Wiley. ISBN 13: 9780471041238. 448p.
8. Antill&Woodhead (1990); “Critical path methods in construction practice”, John Wiley & sons. ISBN-13: 978-0471620570. 440p.
9. Chitkara K K (1998); “Construction Project Management”, Tata McGraw Hill, ISBN 13: 9780074620625, 558p.
10. Barrie D.S. & Paulson B C (1992); “Professional Construction Management” , McGraw Hill., ISBN :13 9780070038899. 577p.
11. Harold R. Kerzner (2013); “Project management: A system approach to planning, scheduling and controlling” John Wiley & Sons. ISBN 13:9781118415856. 1296 p.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PC-MTCM255 Mini Project

Course Code	Course Name
PC-MTCM255	Mini Project

Course Objectives

Students should be able to
1. Educate the student to understand the field problems in civil engineering.
2. To apply the principles of management and suggest remedial measures.

Course Outcomes

Upon successful completion of the course, students should be able to
1. Students will be able to identify the research areas and formulate research objectives for dissertation wok in the area of construction management field
2. Students will be able to prepare reports and present their work in the form of seminars.

Module No.	*Details*
1	**Report on mini Project** The mini project work extends through the third and fourth semester. It is aimed at identifying the research area and formulates research objectives. Students are expected to carry out independent research work on the chosen topic and submit a report of same for evaluation? The work at this stage may involve extensive review of literature, laboratory experimental work, development of software, development of model, case study, field data collection and analysis etc. On completion of the work the student shall prepare a report and will give a Seminar on the report.

PE-MTCM201 Risk and Value Management

Course Code	Course Name
PE-MTCM201	Elective – IV: Risk and Value Management

Course pre-requisites	

Course Objectives
1. To discuss the basics of risk and value management. 2. To explain various mathematical tools used in risk assessment process. 3. To describe value engineering job, plan. 4. To outline the process of life cycle costing.
Course Outcomes
1. To carry out risk analysis and development of mitigation measures. 2. To implement value management process. 3. To execute the life cycle cost analysis

Course Content

Module No.	*Details*	*Hrs.*
1	Risk analysis and Management for projects (RAMP) – Identifying risk events. Probability distribution. Stages in Investment life-cycle; Determination of NPV and its standard deviation for perfectly co-related, moderately co-related and un-correlated cash flows. Sensitivity analysis	07
2	scenario analysis simulation, decision tree analysis, risk profile method, certainly equivalent method; risk adjusted discount rate method, certainty index method, 3 point estimated method; use of risk prompts, use of Risk Assessment tables, details of RAMP process, utility of Grading of construction entities for reliable risk assessment.	06
3	Risk Mitigation – by elimination, reducing, transferring, avoiding, absorbing or pooling. Residual risk, mitigation of unquatified risk. Coverage of risk through CIDC's MOU with the Actuarial Society of India through risk premium such as (BIP) – Bidding Indemnity Policy (DIMO) – Delay in meeting obligation by client policy, (SOC) – Settlement of claims policy (LOP)- Loss of profit policy (TI).	04
4	Transit Insurance policy (LOPCE) Loss of performance of construction equipment policy. Insurance from construction point of view – CAR Policy, EAR Policy, 3rd party risk cover, Professional Liability Insurance policy, Contractor's Plant & machinery policy, and IT risk policy	04
5	Value : Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical,	06

	economic : identifying reasons or unnecessary costs	
6	Value Analysis: value analysis team; principles of value analysis, elements of a job plan viz. orientation, Information, presentation. Implementation, follow up action, benefits of value analysis, various applications; assessing effectiveness of value analysis.	05
7	Value management : Energy resources, consumption patterns, energy cost escalation and its impact, key factors affecting energy consumption in the building and other construction works.	04

Text / Reference Books

1. Faculty of Actuaries (Great Britain), Institute of Actuaries (Great Britain) (2005); "RAMP - Risk Analysis and Management for Projects: A Strategic Framework for Managing Project Risk and Its Financial Implications". Thomas Telford. ISBN 13: 9780727733900. 147p.
2. Seetharaman (2000);" Construction Engineering and Management", ISBN: 9788188114061.487p.
3. Prasanna Chandra (1986); "Projects preparation, appraisal, budgeting & implementation", Tata McGraw Hill. ISBN-13: 978-0074516287. 543p.
4. Dr.Surendra Kumar "Industrial Engineering and Management of manufacturing systems" .Satya Prakashan.
5. Zimmerman & Hart (1982);" Value engineering - a practical approach for owners, designers &contractors", CBS Publishers. ISBN:9780442295875.279p.
6. S C Rangwala ,Estimating Costing and valuation, Charotar Publishing House.
7. Del Younke, Value Engineering: Analysis And Methodology.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM202 International Construction Business

Course Code	Course Name
PE-MTCM202	Elective – IV : International Construction Business

Course pre-requisites	Construction Management

Course Objectives

student will be able to

1. Explain basic concept of international economy with theories of trade.
2. Describe culture of international business.
3. Summarize legal frame in contest of international business.

Discuss about multi project management and regulatory committees

Course Outcomes

1. Distinguish the theories of international trade.
2. Execute multi projects management.
3. Basic of legal frame and regulatory committees.

Course Content

Module No.	*Details*	*Hrs.*
1	**International economy** International political system, economic system, Globalizations, multinationals, features of international trade & investment, national interest in international trade. Impact of EU, SAARC, BRICS, ASEAN on global economy	05
2	**Theories of international trade** OHLINS'S international trade Developing countries in the world economy, international differences in technology, policy implications for host countries International monetary system, balance of international payments, transfer of international payments, foreign exchange rates and their determination. Role of IMF (International Monetary fund), World Bank, IBRD (International Bank for Reconstruction and development), Asian Development Bank	08
3	**Cultural environment of international business:** Elements of culture, culture role, Effect of culture, language, education, religion, value systems on business, impact on management styles in selected countries, cross-cultural differences.	05
4	**Legal Framework and International Trade** Restriction on Import-Export, International Dispute Settlement.	07

	Role of WTO and its Function. International arbitration & case studies.	
5	**Multi project management & control:** International project planning, resource management, document management, Consortium and collaboration, controlling tools, use of ERP for international business, introduction to CVC.	06
6	Introduction to international regulatory committees, GCC/MENA/FU.	03
7	Case studies on international project	02

Text / Reference Books
Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM 203** Infrastructure Planning and Managements (Online Course)

Course Code	Course Name
PE-MTCM 203**	Elective IV: Infrastructure Planning and Managements (Online Course)

Course pre-requisites	

Course Objectives
1) To introduce students to 'real world' risks and challenges in managing infrastructure 2) To explain the infrastructure planning process as well as the state of infrastructure across sectors in India 3) To understand various risks that plague infrastructure projects
Course Outcomes
students will be able to 1. Aware of current risks in infrastructure sector 2. Provide solutions that can help to execute infrastructure projects better 3. Carry out strategic management techniques

Course Content

Module No.	*Details*	*Hrs.*
1	Class Introduction, Introduction to Infrastructure and to the Transportation, power and telecom sectors	04
2	Rural and Urban Infrastructure Sectors, Players and Phases in an Infrastructure Project	03
3	Project Finance and Public Private Partnerships	05
4	Construction and Economic Risks, Political and Social Risks	03
5	Stakeholder Management, Design Thinking and Negotiations, Socio-Economic Analysis and Good Governance for Infrastructure	06
6	Guest Lectures from Infrastructure Practitioner, Modeling Flexible Project Arrangements	05
7	Case Studies, Incomplete Design	06

Text / Reference Books		
1. 'Infrastructure Planning Handbook' by Prof Makarand Hastak, ASCE Press 2. 'Strategic Management of Large Engineering Projects' by Miller and Lessard		
Sr. No.	**Examination**	**Module**
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM211 Management of Construction Resources

Course Code	Course Name
PE-MTCM211	Elective V : Management of Construction Resources

Course pre-requisites	Construction Management

Course Objectives
1. To Describe the concept of human Resources Management 2. To explain concept of equipment Management 3. To summarize concept of material management
Course Outcomes
students will be able to 1. Carry out human Resources Management 2. Execute equipment Management 3. Apply materials management technique in construction

Course Content

Module No.	*Details*	*Hrs.*
1	**Human Resources Management** Need of HRD in the context of globalization Staffing, recruiting, orientation and training, performance evaluating, merit rating Labour Management: Strikes and lockouts, collective bargaining, grievances and grievance settling procedure, labour welfare.	05
2	**Manpower planning** Techniques of manpower planning. Estimation of manpower for company project. Manpower planning at various stages considering a risk due to lead time. Remuneration of a person. Various methods of deciding remuneration, Techniques to decide actual manpower resources	05
3	**Equipment Management** Mechanization on construction projects, selection of major and minor equipment, production estimating, sizing and matching of equipment Sources of construction equipment: purchase, rent and lease, old and new equipment	06
4	**Economics of Equipment** Economics of equipment, useful / economic life of equipment, equipment operation and service, maintenance, depreciation,	06

	obsolescence and replacement Equipment management systems, organizations, record keeping, training to operators, life cycle costing of equipment,	
5	**Materials Management** Importance and role in construction industry. Objectives and functions. Estimation of materials, Classification and codification, Material Requirement Planning. Vendor analysis, Purchase function: legal aspects of purchase, Requisition forms, Quality assurance	06
6	**Inventory Management** Stores Management; Planning layout of stores, Plant & machinery, Digitalization in effective control of stores; Inventory control techniques concept of EOQ , Advantages and limitations of use of EOQ, ABC analysis, Stores management, minimizing wastage, Precautions to be taken during storage and transport Material management systems, Organizations, record keeping.	04
7	Introduction of various software's for construction resource management such as Microsoft Project , Prima Vera, Building Information and Modelling, ERP	04

Text / Reference Books

1. Varma Mahesh (1975); "Construction Equipment, Its Planning & Application", Metropolitan & Co. 539p.
2. Gopalkrishnan (1977); "Materials Management: An Integrated Approach" PHI Learning Pvt. Ltd. ISBN 13: 9788120300279. 280p.
3. Nunnally (2000); "Managing Construction Equipment", Prentice Hall. ISBN 13: 9780139012167. 399p.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM212 Total Quality Management in Construction

Course Code	Course Name
PE-MTCM212	Elective – V : Total Quality Management in Construction

Course pre-requisites	Construction Management

Course Objectives
The main objectives of the course are to 1. To study the concept of quality in construction. 2. To describe the need of MIS in Construction. 3. To explain the need of TQM, ISO and SIX Sigma in Construction.
Course Outcomes
At the end of the course the students shall be able to 1. To carry out quality control in construction. 2. To develop Total quality management system and Management Information System

Course Content

Module No.	*Details*	*Hrs.*
1	Quality: Necessity for improving Quality in the context of Global Challenges.	05
2	Concept of Quality Control, Quality Assurance, Quality Management and Total Quality Management (TQM)	05
3	Study of various Quality Standards in Construction: Related to building materials and other inputs for construction processes, methods and techniques for construction outputs, products and services, such as BIS, BS, Indian standard, British, American, German & Japanese standards, Managing Quality in various projects stages from concept to completion by building quality into design of structures, Inspection of incoming material and machinery In process quality inspections and tests.	06
4	Designing of quality manuals, checklists and inspection reports, installing the quality	06
5	Assurance system, monitoring and control.	05
6	Quality Assurance Department and quality control responsibilities of the line organization. Quality in foundations and piling work, structural work. Concreting, electrical system building facilities, waste recycling and maintenance.	05
7	Developing quality culture in the organization: Training of people, Bench – marking quality. Quality circles.	04

Text / Reference Books
1. Rumane, Abdul Razzak (2011);" Quality management in construction projects", ISBN:

9781439838723 464p.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM213 International Contracting

Course Code	Course Name
PE-MTCM213	Elective – V : International Contracting

Course pre-requisites	

Course Objectives

1. The significance & role of contracts
2. contracts professionals in the world of business

Course Outcomes

1. Describe the fundamental elements of a contract, including basic terms and conditions
2. Develop appropriate selection criteria for vendor selection
3. Be able to choose the right contract type for a given situation

Course Content

Module No.	*Details*	*Hrs.*
1	International contracting – meaning, scope, nature, present status of the International construction market, role of Asia- Pacific region countries in the present construction development. Impact of WTO/GATS on the Indian Construction Sector as regards domestic market and export sector.	04
2	Study and application of various conditions of contract under the FIDIC document development of regulatory framework. Project exports from India. Overview of EC, ICC, ENNA, IChemE & AIA , Emerging contract model – Integrated Project Delivery, Guaranteed Maximum Price contract	05
3	International financing: Various institutions such as WB, IMF, ADB. African bank etc. and their role, rules – regulations in funding various projects, forming alliance, bilateral and multilateral funding, trade practices etc.	06
4	International Projects – Types of BOT systems such as BOT, BOOT, BOO, DBO, BOR, BLT, BRT, BTO & DBGO, MOOT, ROO, ROT, BOLT – Contractual procedures, special features, methods of handling.	08
5	Selection of personnel to suit socio-economic-environmental culture in other countries, suitable organisational structure.	05
6	Disputes Resolving – International Courts, formation of DRB's (Dispute resolving boards) functioning and experiences in India and abroad, Advantages of DRB's	05
7	CASE studies of any 2 major project executed/functioning under International contracting.	05

Text / Reference Books

1. FIDIC documents
2. Simon M.S. McGraw Hill (2007);" Construction Contracts & Claims", New York.

ISBN:9780070574335. 278 p.
3. Unified Contract Documents by CIDC
4. ReboertMatays and Mathews (1995);" Dispute Review Board Manual", ISBN-13: 978-0070410602.
5. K.N.Vaid (1991);" International Construction Contracting", NICMAR Publication. ISBN: 9788185448169

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

PE-MTCM214** Modern Construction Materials (Online course)

Course Code	Course Name
PE-MTCM214**	Elective V: Modern Construction Materials (Online course)

Course pre-requisites	

Course Objectives
1. To discuss the modern construction materials used in construction industry 2. To provide the scientific basis for the understanding and development of construction materials 3. To understand the properties and application of construction materials
Course Outcomes
students will be able to 1. Understand the science and design of construction materials. 2. To Carry out research related to construction materials 3. Practice marketing, decision making, innovation and specification related to construction materials.

Course Content

Module No.	*Details*	*Hrs.*
1	Introduction to the course, Science Engineering and Technology of Materials- 1&2, Atomic Bonding-1, Atomic Bonding-2, Structure of Solids-1, Structure of Solids-2&3	05
2	Movement of Atoms, Development of Microstructure-1, Development of Microstructure-2	04
3	Surface Properties, Response to Stress-1, Response to Stress-2&3, Failure Theories, Fracture Mechanics-1, Fracture Mechanics-2	06
4	Rheology & Thermal properties, Review of Const. Materials & Criteria for Selection, Wood and Wood Products-1	06
5	Wood and Wood Products-2, Wood and Wood Products-3, Polymers, Fiber Reinforced Polymers-1&2, Metals-1, Metals-2, Metals-3	04
6	Bituminous Materials-1, Bituminous Materials-2, Concrete-1, Concrete-2, Concrete-3	05
7	Concrete-4, Concrete-5, Glass, Waterproofing Materials, Polymer Floor Finishes, Anchors	06

Text / Reference Books

1. Building Materials, P.C. Varghese, Prentice-Hall India, 2555.
2. Materials Science and Engineering: An introduction, W.D. Callister, John Wiley, 1994.
3. Materials Science and Engineering, V. Raghavan, Prentice Hall, 1990.

4. Properties of Engineering Materials, R.A. Higgins, Industrial Press, 1994.
5. Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press, 2551.
6. The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess, R.J. Gray & A. Bentur, Prentice Hall, 1998.
7. Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann, 2553.
8. The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin, 1995.
9. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill, 2556.
10. Properties of concrete, A.M. Neville, Pearson, 2554.

OE-MTCM201 Operational Research

Course Code	Course Name
OE-MTCM201	Operational Research

Course pre-requisites	

Course Objectives
1. To impart knowledge in concepts and tools of Operations Research. 2. To understand mathematical models
Course Outcomes
1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables. 2. Students should able to apply the concept of non-linear programming 3. Students should able to carry out sensitivity analysis 4. Student should able to model the real world problem and simulate it.

Course Content

Module No.	*Details*	*Hrs.*
1	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	05
2	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method	07
3	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.	06
4	Scheduling and sequencing - single server and multiple server models - deterministic inventory models	07
5	- Probabilistic inventory control models - Geometric Programming.	05
6	-Sensitivity analysis - parametric programming	03
7	Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	03

Text / Reference Books

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010

6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

OE-MTCM202 Legal Aspects in Construction

Course Code	Course Name
OE-MTCM202	Elective IV : Legal Aspects in Construction

Course pre-requisites	

Course Objectives	
1.	To describe fundamentals of common law and understand bid cycle
2.	To explain Indian contract act and demonstrate the concept contract administration
3.	To summarize students with Laws applicable to construction activity
4.	To interpret various acts in connection with construction activities

Course Outcomes	
1.	Use of law in general and Practice tendering process
2.	Utilize Indian contract act and its provision with respect to construction
3.	Implement contract administration and Use International contract provisions
4.	Use labor laws and other Acts applicable to construction site

Course Content

Module No.	*Details*	*Hrs.*
1	Law and common man	04
2	Construction through contracts ;Types, critical comparison, bid cycle, tender and contract documents, contract conditions, study of contract documents of State PWD and CPWD	06
3	Indian Contract Act; Need, provisions, scope for modifications / improvement	06
4	Contract administration Deviations and extras, claims and their management, disputes and dispute resolution methods, Arbitration and Conciliation Act.	06
5	Laws applicable to construction activity need and broad provisions of : Industrial Disputes Act, Workmen's Compensation Act ,	05
6	Employer's Liability Act, Payment of wages Act, Contract Labour Act, Minimum Wages Act, Inter-state Migrant workmen act, BOCW Act and other acts introduced from time to time	05
7	FIDIC contracts; Contract administration;	04

Text / Reference Books
1. Bajirao Shankarrao Patil (1986); "Legal Aspects of Building & Engineering Contracts" S.B. Patil. 471p. 2. G. T. Gajria, Kishore Gajria (2000); "Law Relating To Building & Engineering Contracts In India", Lexisnexis Butterworths India. ISBN 13: 9788187162162. 538p. 3. P. C. Markanda, Naresh Markanda (2013); "Law Related To Arbitration and Conciliation" Lexisnexis Butterworths India. ISBN 13: 9788180388132. 1570p. 4. Edward R. Fisk, Wayne D. Reynolds (2013); "Construction Project Administration" Pearson Education. ISBN 13: 9780133149258. 432p. 5. Indian Contract Act 1872 6. Arbitration Conciliation Act 1996.4. All Referred Bare Acts 7. CPWD Manual Volume I & II, A Handbook For Government Officials And Contractors

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

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OE-MTCM203 Business Analytics

Course Code	Course Name
OE-MTCM203	Elective – VI : Business Analytics

Course pre-requisites	

Course Objectives

student will be able to

1. The main objective of this course is to give the student a comprehensive understanding of business analytics methods.
2. Understand and critically apply the concepts and methods of **business analytics**. Identify, model and solve decision problems in different settings.

Course Outcomes

1. Students shall be able to have knowledge of various business analysis techniques.
2. Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity

Course Content

Module No.	*Details*	*Hrs.*
1	Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.	06
2	Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.	06
3	Forming Requirements: Overview of Requirements, Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.	07
4	Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling	05
5	Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools	05
6	Recent Trands in: Embedded and colleborative business intelligence,	05

7	Visual data recovery, Data Storytelling and Data Journalism.	02

Text / Reference Books
1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press. 2. Business Analytics by James Evans, persons Education.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

OE-MTCM204 Industrial Safety Engineering (*Online Course)

Course Code	Course Name
OE-MTCM204	Industrial Safety Engineering (*Online Course)

Course pre-requisites	

Course Objectives

1. To impart knowledge on different facets and aspects of engineering systems safety
2. To study tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings

Course Outcomes

students will be able to

1. Understand concepts of engineering systems safety and dimensions of engineering systems safety,
2. Carry out safety design and analysis mathematics,
3. Design for engineering systems safety and control for safety,
4. Integrate safety with other operational goals such as quality and reliability

Course Content

Module No.	*Details*	*Hrs.*
1	Introduction, key concepts, terminologies, and safety quantification	04
2	Safety by design, Hazard identification techniques (e.g., HAZOP, FMEA, etc.)	06
3	Fault tree and event tree analysis (qualitative & quantitative), Bow-tie and quantitative risk assessment (QRA)	05
4	Safety function deployment, Safety vs reliability – quantification of basic events (repair to failure, repair-failure-repair, and combined processes)	04
5	Systems safety quantification (e.g., truth tables, structure functions, minimal cut sets)	05
6	Human error analysis and safety, Accident investigation and analysis	07
7	Application of virtual reality, OSHAS 18001 and OSHMS	06

Text / Reference Books

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OE-MTCM205 Cost Management of Engineering Projects

Course Code	Course Name
OE-MTCM205	Cost Management of Engineering Projects

Course pre-requisites	

Course Objectives
1. Cost management is to reduce the Project cost expended by Direct Costs and indirect costs 2. Establish systems to help streamline the transactions between corporate support departments and the operating units.
Course Outcomes
1. Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units. 2. Use pseudo profit centers to create profit maximizing behavior in what were formerly cost centers

Course Content

Module No.	*Details*	*Hrs.*
1	Introduction and Overview of the Strategic Cost Management Process	06
2	Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.	06
3	Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents	07
4	**Cost Estimations** Methods of cost estimation – Analogous estimates – Parametric estimates & cost aggregation method – Contingency reserve and management reserve in project cost estimations - Cost baseline & cost budgeting, Developing Project Control Budget. Understanding the cost estimates from Engineering, Procurement and Construction point of view.	05
5	**Financial Statements** Understanding Financial Statements, EBITDA, PBIT, PAT, Financial Ratios for understanding Profitability and healthy Cash	05

	Flow management	
6	**Working Capital Management** Working Capital Basics - Working Capital Issues in Projects - Estimating Working Capital - Working Capital ratios - Inventory Ordering Cost - Economic Order Quantity (EOQ) - Work In Progress (WIP).	05
7	**Project Cash flow Management** Project Cash flow, Components of Cash flow - Impact of Cash flow on Project Performance - Construction cumulative cost curves - Earned Value Management concept, Direct & Indirect Cost in Projects, Project overheads, Understanding the aspects of GST, Project Insurance.	02

Text / Reference Books
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi 2. Charles T. Horngren and George Foster, Advanced Management Accounting 3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting 4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher 5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd 6. Prasanna Chandra (2011); "Financial Management", Tata McGraw-Hill Education. ISBN 13: 9780071078405. 1026p.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

OE-MTCM 206Artificial Intelligence in Engineering

Course Code	Course Name
OE-MTCM206	Artificial Intelligence in Engineering
Course Pre-requisites	Applied Mathematics, Engineering in Mathematics, Probability and Statistics, Calculus, Integration, Differential Equations.

Course Objective

The objectives of this course are:

1. To introduce the students to the various soft computing techniques.
2. To prepare the student for the application of artificial intelligence techniques in engineering.

Course Outcomes

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

1. Understand basics of soft computing techniques.
2. Able to apply artificial intelligence techniques to the engineering problems.

Detailed Syllabus		
Module	Content	Hours
1	Introduction to Soft computing techniques- soft computing techniques, importance, types of soft computing techniques, advantages and limitations.	04
2	Introduction to Fuzzy logic: Fuzzy sets Fuzzy set operations- Fuzzy Relations-Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy relations- Membership Functions-Features of Membership functions- Fuzzification-Methods of Membership value Assignments- Fuzzy Rule Base-Defuzzification-Defuzzification methods-Fuzzy logic controller (Block Diagram)	06
3	Artificial Neural Networks: Basic Concepts-Neural network Architectures-Single layer feed forward network-Multilayer feed forward network-Recurrent Networks-Characteristics of Neural Networks-Learning methods. Perceptron networks-Back Propagation Networks-Radial base function network-Hopfield network- Kohonen Self organizing maps.	09
4	Fundamentals of genetic algorithms and Genetic Programming: Basic concepts- working principle - encoding different methods - fitness function, reproduction-different methods. Genetic modelling in heritance- Crossover mutation-convergence of genetic algorithm. Basic difference between genetic algorithm and genetic programming.	10
5	Introduction to Hybrid systems: Concept of hybrid system and its significance in general to water resources problems, Neural network, fuzzy logic and genetic algorithm hybrids - Neuro fuzzy hybrids- neuro genetic hybrids-Fuzzy genetic hybrids-Genetic algorithm based back propagation network- Fuzzy back propagation networks -fuzzy logic controlled genetic algorithms.	10

Recommended Books:

1. Rajasekharan, S. and Vijayalakshmi, G.A.Pai, -Neural Network, Fuzzy Logic and Genetic Algorithms Synthesis and Applications, Prentice Hall India.
2. Sivanandam, S.N and Deepa, S.N. -Principles of Soft Computing, Wiley India
3. Ross Timothy J, -Fuzzy logic with Engineering Applications, McGraw Hill, New York.
4. Haykins S. -Neural Networks a Comprehensive foundation, Pearson Education.
5. Goldberg, D.E. -Genetic Algorithms in Search Optimization and Machine Learning, Pearson Education
Recent Literature

SE-MTCM201 Lab Course-Building Information modeling (BIM)

Course Code	Course Name
SE-MTCM201	Building Information modeling (BIM)

Course pre-requisites	

Course Objectives
1. To educate the student on 3D design of Civil / Commercial Buildings 2. To develop model using Navisworks 3. To monitor progress of work
Course Outcomes
Students will be able to 1. Explain the modeling concept of building information , 2. Illustrate planning, design and construction by using BIM software

Course Content

Module No.	*Details*	*Hrs.*
1	Exploring the User Interface, Working with Revit elements, Creating a basic Floor Plan.	02
2	Working with grids and Structural Columns, adding and Modifying Walls, Loading Additional Building Components, importing and Exporting using External Files and Linking Files	02
3	Creating Advanced Components, Creating and Modifying Parametric Families.	02
4	Viewing the Building Model, Controlling Object Visibility, Creating and Modifying Section And Elevation Views.	02
5	Developing the Building Model, Creating and Modifying Floors, Ceilings, Roofs and Curtain Wall**.**	02
6	Detailing and Drafting, Duplicating Views, Creating Elevations, Creating Section structural Works, Floor Framing, Working with Roofs, Working with Structural Steel Frames.	02
7	Working with Sloped Beams, Working with Floor Decks, Working with Foundation Slabs and Slabs, Footings and Grade Beams, Managing Revisions, User Interface & File Organization.	02
8	Viewing the Building Model, Controlling Object Visibility, Creating and Modifying Section And Elevation Views	02
9	**NevisWorks :** (Model Development User Interface & File Organization, Overriding transparency, color, and object/model location.	02
10	Importing 3D Files, How to import and append 3D model File, Understanding NavisWorks file formats, Object enablers	02

11	Navigation, Zooming, panning, walking around Sectioning, Moving objects, Hiding layers and objects, Establishing Selection Sets.	02
12	Viewpoints, Establishing and organizing custom, Viewpoints, Publishing the model file and Viewpoints, Internal/in-house clash detection, 4D simulation	02

Lab Work

Lab work shall comprise of

1. Report on assignments including problems based on the above syllabus shall be submitted as term work.
2. One assignment on each module is to be submitted.
3. Reports of assignments : 50 points

PC-MTCM202 Lab Course- Project Management Lab

Course Code	Course Name
PC-MTCM202	Project Management Lab

Course pre-requisites	

Course Objectives
1. To educate the student about modern construction management software 2. To apply the knowledge of planning and scheduling technique for a construction project
Course Outcomes
Students will be able to 1. determine the list of activities and their dependencies 2. prepare bids for works, plans and schedules for construction activity using software 3. demonstrate use of general purpose software to develop applications for cash flow generation, resource planning etc.
Course Content
Laboratory work to include; FUNDAMENTALS OF PROJECT MANAGEMENT using M.S .Project Structuring of Projects and Organizations. Applications of Network Techniques using software, Resource profiles, tables, and resource/cost curves; Setting Up a Project, Creating Calendars, Defining Task and Relationship, Creating WBS, Scheduling and Progress of Project, Resource organization in Project Plans, **Monitoring & Control** - Updating and Reporting on Project Performance Monitoring, Controlling and Report Generation. Project structuring, task organizations, scheduling, resources, costs etc. various features and functions available in Primavera. Creating Project, sub-project, activities planning and scheduling calendars Resource definitions: Task types, resource types, resource planning, allocations of cost etc.; Various Structures i.e. WBS, OBS, EPS, etc. Activity codes, Project progress, progress updating: setting baseline, status updating, tracking formatting for printing etc. ***Tilus***

TILOS Interface Overview; Overview of Capabilities and Benefits Time Distance View layout, settings, and properties; Time Scale Distance Scale, Elevation Profiles, Grid Lines, Inserting tasks (activities) Linking tasks (logic/relationships), Calendars, Holidays, and shift patterns Text Fields, Layers, Filters, Task Templates, Resources like Labor, Machines, and Material , Costs and expenditures, Histograms; E**nvironmental Constraints,** Task Groups (Fragnets), Splitting Tasks Adding project milestones, Creating a baseline, Reporting progress Detecting task clashes/conflicts, Reschedule, Adding a Legend, Logo, and images, Hints, Tips, and shortcuts.	

Lab Work

Lab work shall comprise of

1. Report on assignments including problems based on the above syllabus shall be submitted as term work.
2. One assignment on each module is to be submitted.
3. Reports of assignments : 50 points

Sardar Patel College of Engineering, Andheri (West), Mumbai
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AE-MTCM201 English For Research Paper Writing

Course Code	Course Name
AE-MTCM201	English For Research Paper Writing

Course pre-requisites	

Course Objectives

Students will be able to:
1. Understand that how to improve your writing skills and level of readability.
2. Learn about what to write in each section.
3. Understand the skills needed when writing a Title

Course Outcomes

Upon successful completion of the course, students should be able to
1. Demonstrate appropriate English language usage to disseminate scientific findings to the research community.
2. Writing Research Papers Across the Curriculum
3. Conduct appropriate research and synthesize outside sources into writing.

Course Content

Module No.	*Details*	*Hrs.*
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	04
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts.	04
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	05
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature	05
5	Skills needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be The first- time submission.	06

Text Books

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht

Heidelberg London, 2011

Reference Books

1. William Strunk Jr., and Richard De A'Morelli (2018), The Elements of Style: Classic Edition, USA.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 5

AE-MTCM202 Project Planning and Management

Course Code	Course Name
AE-MTCM202	Project Planning and Management

Course pre-requisites	Construction Management

Course Objectives

1. Understand the roles and responsibilities of civil and structural engineer in practice.
2. Understand the important activities and the sequence in which they are to be carried out
3. Learn the importance of accuracy and correctness in work and how this is achieved.
4. Understand the skills required by a civil and structural engineer

Course Outcomes

1. Have a clear understanding of the stages and activities in project execution
2. Draw upon the academic knowledge gained in college to achieve efficiency in actual practice.
3. Appreciate the developments in Civil and Structural engineering and the continuous upgradation of knowledge and skills.
4. To approach industry with enthusiasm, motivation, confidence and a strong pride in the profession

Course Content

Module No.	*Details*	*Hrs.*
1	**Introduction and Early work** • Roles and challenges of the Civil and structural engineer • Planning and scheduling for a project • Budget and Cost control • Surveying activity for a project • Geotechnical Investigation for a project	05
2	**Basic Design of a Project** • Plot Layout Planning, • Construction strategy • Tendering and Contract strategy for a project • Design basis for the project • Important codes, specifications and standards • Site Development	05
3	**Global design** • Important engineering principles and concepts • Preliminary structural analysis and design • Quantity and cost estimation and monitoring • Piling in a project • Material Estimation for ordering	05

	• Construction strategy for a project	
4	**Detailed Design** • Detailed computer analysis and design of structures, • Statutory approvals and permits • 3D computer modelling and interaction with other engineering disciplines. • Design reviews and Change management • 2D Detailed construction drawings for Reinforced concrete, Steel and Architecture	05
5	**Construction Stage** • Steel fabrication drawings and concrete bar bending schedules • Construction management • Safety and Quality Control • Present and future trends in Civil and Structural engineering • Essential skills required by a Civil and Structural engineer	04

Text Books

1. Koontz, O'Donnell &Weihrich (2010); "Management", Mcgraw Hill. ISBN-13: 9780070144958. 464p.
2. Chinowsky, Paul S. & Songer, Anthony D. (2011) "Organization Management in Construction". Routledge. ISBN-13: 978-0415572613. 216p.
3. Sears, Keoki S, (2008) "Construction Project Management: A Practical Guide to Field Construction Management". Wiley. ASIN: B00HQ1CNE2.
4. Frank Harris (2013); "Modern Construction Management", Ronald Mccaffer Wiley Blackwell Publications. ISBN-13: 978-0470672174. 572p.
5. Wagner.Harvey M (1975) "Principles of Management Science" Prentice Hall College Div. ISBN-13: 978-0137095353. 612p.
6. Snell, Scott & Bohlander George (2009) "Managing Human Resources" South-Western Cengage Learning; ISBN-13: 978-0324593310. 864p.
7. Dessler, Gary (2008) "Human Resource Management" Prentice Hall. ISBN-13: 978-0131746176. 801p.
8. Dharwadkar P. P (1992); "Management In Construction Industry" Oxford & IBH Luthans.
9. V. J. Davies, K. Tomasin (1996); "Construction Safety Handbook", Thomas Telford, London. Isbn-13: 9780727725196. 303p.
10. PSG Design Data Book, PSG College, Coimbatore (2012)

Reference Books

1. Construction Safety Manual Published By National Safety Commission of India.
2. "Safety Management in Construction Industry" – A Manual for Project Managers. Nicmar Mumbai.
3. "IS For Safety In Construction – Bureau Of Indian Standards.
4. Girimaldi and Simonds (1989); "Safety management", AITBS, New Delhi. ISBN: 9780939874989.651p.
5. Stranks, Jeremy (2010) "Health and Safety at Work: An Essential Guide for Managers", Kogan Page Publishers. ISBN 13: 9780749461201. 352p.

Sr. No.	Examination	Module
1	T-I	1 and 2
2	T-II	3 and 4
3	End Sem	1 to 5

M.Tech. in Civil Engineering with

Construction Management

SEMESTER III

Sardar Patel College of Engineering, Andheri (West), Mumbai
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VE-MTCM301 Disaster Management

Course Code	Course Name
VE-MTCM301	Disaster Management

Course pre-requisites	

Course Objectives

Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes

On completion of the course, the student will develop competencies in

1. Applying concepts of disaster to management
2. Analysing relationship between development and disasters
3. Ability to understand categories of disasters
4. Realization of the responsibilities to society

Course Content

Module No.	*Details*	*Hrs.*
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	04
2	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	04
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.	04
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data	04

	From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	
5	**Risk UIdentification** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation.	02
6	**Risk Assessment** Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	02
7	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	04

Text / Reference Books

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

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VE-MTCM 302 Introduction to Sustainability and Sustainable Development

Course Code	Course Name
VE-MTCM 302	Introduction to Sustainability and Sustainable Development
Course pre-requisites	NA

Course Objectives

1. This course provides an in-depth understanding of sustainability and sustainable development goals to create a better- informed engineer, which will lead to a more sustainable action by all and for all.

Course Outcomes

Students will be able to:

1. Understand the basic concept of Sustainability and Sustainable Development (SD), history of SD, the environmental, social and economic dimensions of SD and be able to discuss the SD concept on the national as well as on the global scale with respect to engineering
2. Apply the fundamental concepts related to interaction of industrial and environmental/ecological systems, sustainability challenges facing the current generation, and systems-based approaches required for creating sustainable solutions for society.
3. Apply sustainable practices by utilizing the engineering knowledge and principles.
4. Deliberate on potential strategic options and tools for assessing SD (efficiency, sufficiency).

Course Content

Module No	Contents	Time (Hrs)
1	**Introduction**: What is sustainability and sustainable development? – definitions, Concept & components of sustainability **Limits to exponential growth on a finite planet**, Complexity of growth and equity, Environmental issues and crisis, Resource degradation, greenhouse gases, global warming, desertification, social insecurity, industrialization, globalization. **An Engineers role in sustainability**	02
2	**Sustainability perspective for Energy, Materials, Water, Food and Shelter:** World energy usage, Problems with fossil fuels Alternatives - reduction, efficiency, renewable energy. Impacts of material production, sources of waste, Problems with current waste management, Suggestions for reducing the impact of material use Water resource and use worldwide, Associated problems with current water systems, Sustainable water management, World food production, Usage of resources and environmental impacts, Alternatives - organic/local Current building styles and associated problems, Retrofit vs new build Sustainable Architecture	06
3	**Social & Economic Sustainability** Social sustainability - Components - equality, diversity, democracy, social cohesion, Issues - gender issue, poverty, environmental degradation, peace & justice, social sustainability performance - community engagement, community development, empowerment, health, volunteerism, etc. Economic sustainability - Relationship between macroeconomics policies, poverty and environment, Trade-offs between economic growth, social equity, and environmental sustainability, Role of international environmental agreements, green economy and climate change policies.	05
4	**Governance for Sustainable Development Systems**: Socio-economic policies for sustainable development, Strategies for implementing eco-development programmes, Policy responses to environmental degradation, Public participation - Demographic dynamics and sustainability, Integrated approach for resource protection and management.	03
5	**Strategies and measurements of SD**: Introduction to Sustainability assessment,	03

	Environment Sustainability metrics – simple and complex indicators, Sustainability methods and assessment - green buildings, Renewable energy, CSR, Biodiversity, Technologies, human development index (HDI), sustainability development index (SDI), LCA	
6	**The road to Sustainable Development** - National and International Contribution: National Contribution: Societal transformations. Institutional theory, Rural and Urban development, Action plan for implementing sustainable development International Contribution - Brundtland, Rio summit, SDGs, Conventions, Protocols & Agreements, Action plan for implementing sustainable development, Moral obligations and Operational guidelines, Role of developed countries in the sustainable development.	03
7	**Project Presentations**	04

Text Books:

1. Harris, J.M., Basic Principles for Sustainable Development, Global Development and Environment Institute, working paper 00-04. Available at:http://ase.tufts.edu/gdae/publications/Working_Papers/Sustainable%20Development.PDF
2. Mackenthun, K.M., Basic Concepts in Environmental Management, 1 st edition, Lewis Publication, London, 1998.
3. Hjorth, P. and A. Bagheri, Navigating towards Sustainable Development: A System Dynamics Approach, In Futures, 38(1): 74-92, 2006.
4. Mog, J.M., Struggling with Sustainability – A Comparative Framework for Evaluating Sustainable Development Programs, World Development 32(12): 2139–2160, 2004.

Reference Books:

1. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-
2. Rating System, TERI Publications – GRIHA Rating System
3. Indian Green Building Council, IGBC Green Buildings rating system (New & Existing) - Abridged Reference Guide, Pilot Version, 2017.
4. IISD Commentary on the OECD's Draft Principles for International Investor Participation in Infrastructure (PDF – 68 kb)

Courses to refer

Sustainability and Engineering :
https://rdmc.nottingham.ac.uk/bitstream/handle/internal/112/Engineering%20Sustailability

VE-MTCM303 Safety in Construction

Course Code	Course Name
VE-MTCM303	Safety In Construction

Course pre-requisites	

Course Objectives
This course aims to make the students well-versed with the latest safety and health regulations and the Indian Standards applicable to the construction industry.

Course Outcomes
At the end of this course, the students will be able 1. Identify, assess and manage potential hazards effectively. 2. Implement and monitor safety protocols. 3. Develop comprehensive safety audit reports. 4. Understand the legal and regulatory requirements for construction safety.

Course Content

Module No.	*Details*	*Hrs.*
1	Basic terminology in safety, types of injuries, safety pyramid Accident patterns, theories of accident-causation	04
2	Planning for safety budget, safety culture	04
3	Introduction to OSHA regulations; Role of stakeholders in safety	04
4	Safety in the project design office and site office, Site safety programs - Job hazard analysis, accident investigation & accident indices violation, penalty	04
5	Safety during construction, alteration, demolition works – Earthwork, steel construction, temporary structures, masonry & concrete construction, cutting & welding	02
6	SoPs (Safe Operating Procedures) – Construction equipment, materials handling-disposal & hand tools	02
7	Other hazards – fire, confined spaces, electrical safety; BIM & safety	04

Text / Reference Books

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

DS-MTCM 301 Dissertation Phase-I

Course Code	Course Name
DS-MTCM 301	Dissertation Phase-I

Course pre-requisites	

Course Objectives
Students will be able to: 1. To enrich the knowledge of construction management and their application in the construction project. 2. To identify the potential research gap and propose research methodology.
Course Outcomes
Students will be able to: 1. Students will be able to do detailed literature review and formulate problem statements related to their research area. 2. Students will be able to carry experimental work, data collection, and development of models.

Module No.	*Details*
1	**Seminar on Literature Review** The project work extends through the third and fourth semester. The project work is defined based on the interest of the students to specialize in a particular area. Students are expected to carry out independent research work on the chosen topic and submit a thesis for Scheme of evaluation? The work at this stage may involve review of literature, laboratory experimental work, development of software, development of model, case study, field data collection and analysis etc. On completion of the work the student shall prepare a report and will give a Seminar on the report. Also, Student shall finalize a theme, related to construction engineering and/or management area for the dissertation work. Student shall prepare a report on the theme outlining importance of the theme of the study, objective, scope of work, methodology, and a review of literature published in the relevant area. The student shall present seminars on this report.
2	**Stage-I Seminar** Topic Selection ; Literature Review; Knowledge integration to formulate problem statement; Plan of problem solving Methodology (tools and technique); Presentation skills

M.Tech. in Civil Engineering with Construction Management

SEMESTER IV

CC-MTCM401 Stress Management By Yoga

Course Code	Course Name
CC-MTCM401	Stress Management By Yoga

Course pre-requisites	

Course Objectives
1. To achieve overall health of body and mind 2. To overcome stress
Course Outcomes
Students will be able to: 1. Develop healthy mind in a healthy body thus improving social health also 2. Improve efficiency

Course Content

Module No.	*Details*	*Hrs.*
1	Definitions of Eight parts of yog. (Ashtanga)	04
2	Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha	08
3	ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	04
4	Asan and Pranayam i) Various yog poses and their benefits for mind & body	04
5	ii)Regularization of breathing techniques and its effects-Types of pranayam	04

Text / Reference Books

1) 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2) "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

DS-MTCM401 Dissertation Phase-II

Course Code	Course Name
DS-MTCM401	Dissertation Phase-II

Course pre-requisites	

Course Objectives
Students will be able to: 1. To enrich the knowledge of construction management and their application in the construction project. 2. To identify the potential research gap and propose research methodology.

Course Outcomes
Students will be able to: 1. Students will be able to analyze their research problem statement and derive inferences/results. 2. Students will be able to prepare a final dissertation report and present the same.

Module No.	*Details*
1	**Seminar (Pre –Synopsis)** Student shall study the problem of dissertation in the light of outcome of Stage I and Stage II seminars. On completion of data collection, analysis, and inference the student shall prepare an interim report and shall present a seminar on the work done, before the submission of Synopsis to the University
2	**Dissertation and Viva Voce** On finalization of the dissertation student shall submit the dissertation report to the University. The student shall have to appear for a Viva-voce examination for the dissertation.