# **COEP Technological University Pune**

(A Unitary Public University of Govt. of Maharashtra)

**School of Civil Engineering and Planning** 

# **Curriculum Structure**

M.Tech (Construction Management)

(Regular)

# **Civil Engineering**

(Effective from: A.Y. 2023-24)

# **Program Educational Objectives (PEOs)**

Program educational objectives are as described below:

- **I.** Succeeding in development of career in the field of construction management and / or higher studies by acquiring knowledge in quantitative management analysis, research methodology, construction planning and techniques.
- **II.** Analyze and optimize Civil engineering systems with social awareness and responsibility.
- **III.** Exhibit professionalism, ethical approach, leadership, communication skills, team work in their profession and adapt to modern trends by engaging in lifelong learning.

# **Program Outcomes**

**PO1:** An ability to independently carry out research /investigation and development work to solve practical problems

**PO2:** An ability to write and present a substantial technical report/document

**PO3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

**PO4:** Adopt the relevant knowledge and cutting-edge technologies through lifelong learning process and acquire professional and intellectual integrity, professional code of conduct, ethics understanding of the social responsibility for sustainable development of society.

**PO5:** Observe and examine critically the outcomes of referred problem and make corrective measures subsequently and learn from mistakes.

# List of Abbreviations

Abbreviation	Title	No of courses	Credits	% of Credits
PSMC	Program Specific Mathematics Course	1	4	5.9
PVSEC	Program Specific Bridge Course	1	4	5.9
PEC	Program Elective Course	3	9	13.2
MLC	Mandatory Learning Course	2	0	0.0
PCC	Program Core Course	5	16	23.5
LC	Laboratory Course	5	7	10.3
UOE	University Open Elective	1	3	4.4
CCA	Course Curricular Activity	1	1	1.5
SLC	Self-Learning Course	2	6	8.8
VSEC	Vocational Skill Based Enhancement Course	2	18	26.5
	Total	23	68	100

# M.Tech. in Construction Management

# [Regular]

# Semester -I

Sr. No	Course Code	Course Title	L	Т	Ρ	S*	Cr	Category
01	CM- 23001	Probability & Data Analysis	3	1		1	4	PSMC
02	CM- 23002	Construction Project Planning and Management	4	0		1	4	PVSEC
	CM(PE)- 23001	Departmental elective-I Building Information Management						
	CM(PE)- 23002	Application of Geographic Information System				1	3	PEC
	CM(PE)- 23003	Project Economics & Financial Management						
03	CM(PE)- 23004	Sustainable Construction	3					
	CM(PE)- 23005	Quantitative methods in construction management						
	CM(PE)- 23006	Functional Planning, Building Services and Maintenance Management						
	CM(PE)- 23007	Sensors and Automation						
	<u></u>	Any course approved by BOS						
04	СМ- 23003	Management	4			1	4	PCC
05	CM- 23004	Construction Equipment and Machinery	3		-	1	3	PCC
06	CM- 23005	Construction Management Laboratory-I	-		4	-	2	LC
07	CM- 23006	Construction Management Laboratory-II	-	-	2	-	1	LC
08	CM- 23007	Seminar	-		2	1	1	LC
		Total	17	01	08	06	22	

<sup>\*</sup> Faculty Incharge should declared syllabus which will be studied by students in self learning mode. Teacher should declaresyllabus and give references for the same

Sr. No	Course Code	Course Title	L	Т	Ρ	S*	Cr	Category
01		Interdisciplinary Open Course	3	-	-	1	3	UOE
02	CM(PE)- 23008	Departmental Elective-II Total Quality Management and MIS in Construction						PEC
	CM(PE)- 23009	Sustainability and Urban Planning						
	CM(PE)- 23010	Application of Optimization Techniques in Construction Management	3 -	-		1	3	
	CM(PE)- 23011	Soft Computing Techniques						
	CM(PE)- 23012	Underground Opening						
		Any course approved by BOS						
	CM(PE)- 23013	Departmental Elective-III Environmental impact assessment						
	CM(PE)- 23014	Construction Safety and Human Resource Development in Construction		3		1	3	PEC
03	CM(PE)- 23015	Infrastructure Development and Management	3					
	CM(PE)- 23016	Artificial Intelligence and Machine Learning Applications for Construction Management						
	CM(PE)- 23017	Road Safety and Road Safety Audit						
		Any course approved by BOS						
04	ML- 23001	Research Methodology and Intellectual Property Rights	2	-	-	1	-	MLC
05	CM- 23008	Construction Cost Dynamics	3	-	-	1	3	PCC
06	CM- 23009	Construction Techniques	3	-	-	1	3	PCC
07	CM- 23010	Professional Practices in Construction	3	-	-	1	3	PCC
08	LL	Liberal Learning Course	1	-	-	-	-	CCA
09	CM- 23011	Construction Management Laboratory- III	-	-	4	1	2	LC
10	CM- 23012	Mini Project	-		2	1	2	LC
Total 21 00 06 09 22								

# Semester -II

# Semester -III

Sr. No.	Course Code	Course Title	L	Т	Ρ	S*	Cr	Category
01		Dissertation phase-I	-	-	18	2	9	SBC
02		Massive Open Online Course	3	-	-	2	3	SLC
		Total	03	00	18	04	12	

# Semester -IV

Sr. No.	Course Code	Course Title	L	Т	Ρ	S*	Cr	Category
01		Dissertation phase-II	-	-	18	2	9	SBC
02		Massive Open Online Course	3	-	-	2	3	SLC
		Total	03	00	18	04	12	

Exit option : PG Diploma in Civil-Construction Management After successful completion of First Year of the program and eight weeks domain specific industrial internship of one Credit.

<sup>\*</sup> Faculty Incharge should declared syllabus which will be studied by students in self learning mode. Teacher should declaresyllabus and give references for the same

# **Course Structure for M.Tech (Construction Management)**

# **FIRST YEAR**

# <u>Semester I</u>

# **CM-23001** Probability and Data Analysis

Teaching Scheme Lectures: 3 Hrs/ week Tutorial: 1 Hrs/ week Examination Scheme T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Utilize appropriate statistical methods in transportation engineering problems.

**CO 2:** Apply the rule of probability and discrete distributions in solving problems.

**CO 3:** Evaluate the goodness of fit by using statistical decision.

**CO 4:** Apply the knowledge of optimization technique and use statistical software in analysis of transportation engineering problems

# Syllabus Contents:

Introduction: Statistical methods, scope and limitations, population and sample, frequency distribution-measure of central tendency-measures of Dispersion- standard deviation, coefficient of variation, skewness. Variables - scatter diagram, Curve fitting methods, correlation linear regression, and multiple linear regressions. Multivariate data analysis.

Probability: Review, Addition & Multiplication Rules, random Variables, Discrete distributions – Binomial, Poisson, Geometric, Hypergeometric Distribution, Continuous Distribution – Exponential, & normal Distributions, applications in Highway engineering problems.

Statistical decisions: hypothesis testing, significance levels – Tests concerning Mean, testing the equality of means of two populations, tests concerning the variance. Chi–square Test for goodness of fit, The Z-Score Test, The T-Test, Confidence Interval. Forecasting and Time Series Analysis Problems

Linear Programming: methods for maximizing, methods for minimizing, etc. Transportation models, assignment model, queuing theory, Applications in Transportation engineering, Use of mathematical and statistical software packages

# **References:**

1. Gupta, S.C. and Kapoor V.K. Fundamentals of Mathematical statistics, Sultan Chand and Sons, 1978.

2. Medhi J (1982) Introduction to statistics. New age publications, New Delhi.

3. Walpole R. E. and R. H. Mayers (1982): Probability and statistics for Engineers and Scientists. Wiley Intl. 2002.

- 4. Johnson R and G. Bhattacharya (1985): Statistics -Principles and methods. John Wiley, NY.
- 5. Ross S. M. Probability and statistics for Engineers. Wiley Int. Edition.
- 6. Kadiyali L.R. Traffic Engineering and Transport Planning, Khanna Publishers, 2004

# **CM-23002** Construction Project Planning and Management

Teaching Scheme

**Examination Scheme** 

Lectures: 4 Hrs/ week

**T1 and T2 -** 20 marks each

End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Evaluate the time cost trade-off of various resources needed on construction project

**CO 2:** Investigate the practical application of project /construction management.

- **CO 3:** Apply, execute and monitor the modern project planning and management practices
- **CO 4:** Create construction project schedules.

# **Syllabus Contents:**

Traditional management and modern scientific management.

Principles of management, Theories of Taylor, Fayol, Mayo, McGregor, Weber, Gilbreth. Project Management -Basic forms of organization. Role of planning department in construction projects. Construction Project life cycle. Construction scheduling using Gantt chart, milestone chart.

Network techniques like CPM, PERT, Precedence network (PNA), GERT, Ladder, Line of Balance technique. Updating of network, time-cost trade-offs. Resource constrained scheduling and resource levelling. Applications of CPM/PERT, statistical concepts, Man-Material-Machinery-money optimization Site layout and mobilization,

Work Study- time and motion study. Human resource management

- 1. Sengupta and Guha, Construction Management and Planning, Tata McGraw Hill Publication.
- 2. K Nagrajan, Project Management, New age International Limited.
- 3. Barrie & Paulson, Professional Construction Management, McGraw Hill Institute Edition.
- 4. Roy, Pilcher Construction Management
- 5. Jha, Construction Project Management, Theory and Practice, Pearson
- 6. Chitkara, Construction Project Management Planning, Scheduling and Controlling
- 7. Harris and McCaffer, Modern Construction Management
- 8. Pilcher R. (1966). Principles of Construction Management. McGraw Hill Publishing Co Ltd
- 9. O'Brien, Plotnick, CPM in Construction Management, McGraw Hill

# CM(PE)-23004 Sustainable Construction

Teaching Scheme

Lectures: 3 Hrs/ week

Examination Scheme T1 and T2 - 20 marks each

End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Categorize various concepts of sustainable construction

**CO 2:** Apply sustainability to project planning

**CO 3:** Develope appropriate sustainable materials and renewable energy techniques for civil engineering projects

**CO 4:** Analyzing construction's impact on environment.

# **Syllabus Contents:**

MODULE 1

Sustainability and Sustainable Development.

Introduction to course. Introduction to sustainable development Concepts and Theory. Definitions and Prospective on sustainability, Theory and background to sustainable construction planning. The Three E's. Environment, Economics, and Ethics. Ecology of sustainable developments.

MODULE 2

Sustainable Construction Planning.

Introduction to Sustainable construction. Principles of sustainability. Major Environmental challenges, Global Warming.

Introduction to Green Buildings

Building energy system. Strategies, Energy conservation in buildings. Energy Efficient projects. HVAC Systems.

Water Conservation in buildings. Rain water harvesting and management, Water Cycle strategies.

MODULE 3

Green Buildings

Introduction, Green construction, Site selection for Green Construction, Design Considerations, Objectives of Green building movement.

Green construction materials and resources. Material Selection Strategies. Eco-friendly Materials, Recyclable and Reusable Materials. Embodied Energy in Materials. MODULE 4

Green Building Codes and Specifications.

Introduction. Green building Codes and Standards.

LEED Credits, IGBC.

International Construction Codes, Carbon accounting, Green building Specifications.

- 1. Green Building Design and Delivery, 2nd Edition, John Wiley, Hoboken -New Jersey.
- 2. Energy Efficient Buildings in India. Ed. Mujumdar Mili. TERI PRESS.
- 3. Energy efficient buildings in India. Case Studies by Teri. Video Cassettes, ds.
- 4. Climate Responsive Architecture. Krishna Arvind.
- 5. Energy Management Handbook, Steve Doty and Wayne C. Turner, 8th edition.

# **CM-23003** Construction Materials and Materials Management

Teaching Scheme

Lectures: 4 Hrs/ week

Examination Scheme T1 and T2 - 20 marks each

End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Describe advanced construction materials and its application in construction

**CO 2:** Evaluate various inventory models in construction industry

**CO 3:** Apply suitable inventory models for material management

**CO 4:** Examine the governmental buying process, MIS and experience field work regarding material

# Syllabus Contents:

Materials and their properties required for Modern buildings. Special construction materials like fly ash, silica fume, FRP, FRC, admixtures SCC, HPC. Soils and Rock materials in different zones, cut off trenches in earth dam. Mode of transport and receipt of above materials. Testing at site, inspection procedures. Importance and functions of material management, Classification and Codification of materials, Procurement, identification of sources of procurement, vendor analysis. Application of ABC and EOQ analysis in inventory control. Use of Indices in materials/ inventory models Inventory Management, safety stock, stock outs, stores management: Quality Control, Use of MIS and Materials Management Systems, Foreign purchase, Governmental buying.

Introduction to materials productivity and role of materials management techniques in improved materials productivity. Cost reduction and value improvement. Role of purchasing in cost reduction. Value analysis for right choice and rationalisation of materials. Purchasing research identification of right sources of supplies. Vendor rating. Standardisation and variety reduction.

Negotiations and purchase. Price analysis. Organisation of purchasing function. Product explosion. Materials requirements planning. Make or buy decision. Incoming materials control acceptance, sampling, inspection. Vendor certification plans. Vendor and supply reliability.

Inventory management, inventory models. Inventory models with quantity discount. Exchange curve concept and coverage analysis. JIT. Information systems for inventory management. Stores management and warehousing. Optimal stocking and issuing policies. Inventory management of perishable commodities. Surplus management. Design of inventory distribution systems. Monitoring MM effectiveness. Case studies related to procurement process, tendering process, e-Governance.

- 1. Ghose, Materials of Construction' by, Tata- McGraw Hill Publication.
- 2. Gopalkrishnan, Handbook of Materials management, Prentice Hall Publication.
- 3. A.K. Dutta, Materials Management
- 4. Dean S. Ammer, Materials Management and Purchasing, Taraporevala

Publications

- 5. B.K. Roy Chowdhury, Management of Materials, S. Chand & Sons
- 6. Deb, Materials Management
- 7. Lee and Dobler, Purchasing and Material Management, McGraw Hill Publications
- 8. P. Gopalakrishnan and Sundaresan, Materials Management An Integrated Approach, Prentice Hall of India
- 9. K.S. Menon Purchasing and Inventory Control, Wheeler Publishing
- 10. Magee and Boodman, Production, Planning & Inventory Control
- 11. Martin K. Starr and Miller, Inventory Management, Prentice Hall of India Pvt. Ltd.

# **CM-23004** Construction Equipment and Machinery

Teaching Scheme

Lectures: 3 Hrs/ week

Examination Scheme T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Recognize the use of different construction equipment for specific jobs

**CO 2:** Calculate the output of equipment based on its performance out of fleet

**CO 3:** Evaluate useful life of equipment and conclude replacement policy

**CO 4:** Formulate the cost analysis for owning and operating heavy equipment

# Syllabus Contents:

Identification-Planning-Equipment management in projects –Various costs associated with equipment, Maintenance Management-Replacement-Cost control of Equipment-Depreciation Analysis.

Fundamentals of earthwork Operations-Earth moving Operations-Types of Earthwork Equipment-Tractors, Motor Graders, Scrapers, Front end waders, Earth Movers Equipment for Dredging, Trenching, Tunnelling, Drilling, Blasting-Equipment for Compaction-Erection Equipment-

Types of pumps used in Construction-Equipment for Dewatering and Grouting-Foundation and Pile Driving Equipment.

Forklifts and Related Equipment-Portable Material Bins-Conveyors-Hauling Equipment. Crushers-Feeders-Screening Equipment-HandlingEquipment-Batching and Mixing Equipment-Hauling, Pouring and Pumping Equipment-Transporters. Equipment for production of aggregate and concreting.

Factors affecting selection of equipment - technical and economic, construction engineering fundamentals, Analysis of production outputs and costs, Characteristics and performances of equipment for Earth moving, Erection, Material transport, Pile driving, Dewatering, Concrete construction (including batching, mixing, transport, and placement) and Tunnelling. Few case studies based on above content is recommended.

- 1. Robert L. Purifoy and Clifford J. Schexnayder Construction Planning, Equipment and Methods, McGrew Hill Publication, Sixth Edition, 2002.
- 2. Singh Jagman, Heavy Construction Planning, Equipment and Methods, Oxford and IBH Publishing Co. Ltd, New Delhi, Second Edition.
- 3. Varma Mahesh, Construction Equipment and it Planning and application, Metropolitan Book Co., Reprint Edition.
- 4. CECR's (Construction engineering Construction Reviews) manuals on machinery.
- 5. Frank Harris and Ronal Caffer, Management of Construction equipment Macmillan Publication.

# CM-23005, CM-23006 Construction Management Laboratory I & II

**Teaching Scheme Practical: 6** Hrs/ week

**Examination Scheme** End Sem. Exam. - 100 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Select relevant national and International codes for performing new experiments in various laboratories

**CO 2:** Exercise hands on experience to develop higher level motor skills

**CO 3:** Prepare practical and site visit report for various assigned activities

**CO 4:** Develop mathematical thinking in the conduct of different experiments and presentation of results precisely

# Syllabus Contents:

Student will perform various sets of experiments in the following laboratories as decided by the Laboratory In-charge and write a test report as a part of Laboratory work. Minimum eight experiments to be performed.

- A. The advance tests on materials will be carried out in
- a) Transportation Engineering Laboratory
- b) Geotechnical Engineering Laboratory
- c) Concrete Technology Laboratory
- B. Field visits for studying construction management
- C. Assignments

# **CE(PE)-23007** Sensors and Automation

**Teaching Scheme Practical : 3** Hrs/ week **Examination Scheme End Sem. Exam.** - 100 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Recognize the working of commonly used sensors for measurement of temperature, position, accelerometer, vibration sensor, flow and level.

**CO 2:** Compute the application of machine vision.

**CO 3:** Conceptualize signal conditioning and data acquisition methods.

**CO 4:** Comprehend smart sensors and their applications in automation systems

#### **Syllabus Contents:**

Sensors and Transducer: Definition, Classification of transducers, Advantages and Disadvantages of Electrical Transducers.

- Measurement of displacement using Potentiometer, LVDT; Measurement of force using strain gauges & load cells.
- Measurement of pressure using LVDT based diaphragm & piezoelectric sensor, earth pressure cell, Humidity Sensor,

• Proximity sensor: Inductive, Capacitive & Photoelectric, Use of proximity sensor as accelerometer and vibration sensor; temperature sensors (RTD,Thermocouple)

• IR sensors, optical sensor, Corrosion Sensors, acoustic emission sensors, inertial sensor, Fuel sensor

• Imaging Sensors: CCD and CMOS; sensing & digitizing function in machine vision, image processing and analysis.

• Smart Sensor: General Structure of smart sensors & its components, Characteristic of smart sensors , Application of smart sensors

• Signal Conditioning: Introduction, Functions of signal conditioning equipment, need for amplification of signals,

• Data Acquisition Systems and Conversion: Introduction, Objectives & configuration of data acquisition system, Analog & Digital IO, Counters, Timers, need of data conversion

Industrial Automation: Concept, automation components, necessity and working principle, block schematic of Programmable Logic Controller (PLC). Input & Output modules (AI, DI, AO, DO), Introduction to Ladder Programming, introduction to Distributed Control Systems (DCS). Industrial automation leads to Industrial IOT and Industry 4.0.

- 1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
- 2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
- 3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
- 4. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
- 5. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI 2001

# CM-23007 Seminar

# Teaching Scheme

**Practical :** 1 Hrs/ week

**Examination Scheme End Sem. Exam.** - 100 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Identify a topic for study and carry out literature survey.

**CO 2:** Write a technical report related to selected topic

**CO 3:** Present outcome of the study with the help of ppt.

CO 4:

# **Syllabus Contents:**

Seminar is to be performed and reported by the end of the first semester

# Semester II

# **CM-23008** Construction Cost Dynamics

# Teaching Scheme

# Lectures: 3 Hrs/ week

# Examination Scheme

T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Execute economic analysis of different construction projects

**CO 2:** Interpret the importance of risk and its application in construction project

**CO 3:** Apply knowledge of construction cost dynamics to bid a project

**CO 4:** Implement concepts of finance management in practice.

# Syllabus Contents:

Introduction to Engineering economics: Importance, demand and supply, types of costs, interest – simple, compound, continuous, effective.

Value of Money – Time and equivalence, tangible and intangible factors, introduction to inflation.

Interest factors – Uniform series factors – derivations.

Economic comparisons -

Present worth method, equivalent annual cost method, capitalized cost method, net present value, and internal rate of return evaluation of alternatives.

Project cash flow, Factors affecting project cash flow.

Depreciation and tax considerations in alternative replacement analysis comparisons. Benefit cost ratio, public projects evaluation.

Breakeven analysis, risk analysis Earned value management, Escalation Bidding Model Basic concept of financial management- working capital management, balance sheet, funds flow statement.

- 1. Riggs, J.L., Bedworth, D.D., and Randhawa, S.U. (2005). Engineering Economics Tata- McGraw Hill Publishing Co Ltd.
- 2. Tarquin, A.J. and Blank, L.T. (2012) Engineering Economy, A Behavioural Approach McGraw Hill Book Company, 7e.
- 3. Taylor, G.A. (1968). Managerial and Engineering Economy. East-West Edition
- 4. Thuesen, H.G. (1959). Engineering Economy, Prentice-Hall, Inc.
- 5. Van Horne, J.C. (1990). Fundamentals of Financial Management, Prentice-Hall of India Ltd.
- 6. Brigham, E.F. (1978). Fundamentals of Financial Management, The Dryden Press, Hinsdale, Illinois.
- 7. Kolb, R.W. and Rodriguez, R.J. (1992). Financial Management. D.C. Heath & Co.

# **CM-23009 Construction Techniques**

Teaching Scheme

Lectures: 3 Hrs/ week

Examination Scheme T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Recognize modern construction techniques and processes

**CO 2:** Prepare action plan for the various construction activities

**CO 3:** Create action plan for the various construction activities and the corresponding state-of the-art in techniques

**CO 4:** Justify relevant technique and corresponding construction sequence

# Syllabus Content:

Roads: Various techniques for rigid and flexible pavements, overlays.

Bridges: Types, Construction methods for sub-structure and super-structure, various launching methods, coffer dams, caissons.

Tunnels: Construction methods in different strata, Tunnel linings, various methods of construction, trench less technology, underground construction.

Ports: Construction of docks & Jetties, Fender Systems, Container terminals & oil terminals, under water construction, dredging.

High-rise construction: Construction systems for high rise structures, special techniques required for construction and maintenance. Foundation treatment - Grouting, Underwater concreting, Piles, Earth dams and Gravity dams.

Specialized Constructions and Construction Techniques: Methods of dewatering slip form technique, diaphragm wall construction.

Demolition of tall structures

# **References :**

1. Chaundley R. Construction Technology Vol-I to Vol-IV, ELBS Edition

- 2. Seeley Ivor, Building Technology, McMillan
- 3. Christian John A., Management, Machines and Methods, Oxford I & IBH
- 4. Hewry Parker and Clarkson Oglesby, Methods Improvement for Construction Managers

5. Singh Jagman, Heavy Construction Planning, Equipment and Methods, Oxford and IBH

6. Peurifoy and Schexnayder, Construction Planning, Equipment and Methods, McGraw Hill 7. Construction Equipment and its Planning and Application by Mahesh Varma.

# **CM-23010** Professional Practices in Construction

# Teaching Scheme

Lectures: 3 Hrs/ week

Examination Scheme T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Identify important provisions in various construction contract formats

**CO 2:** Understand importance of various provisions in Indian Contract Act

CO 3: Prepare valuation report for residential building

**CO 4:** Implement dispute resolution techniques in practice.

# **Syllabus Content:**

Introduction to Legal terms, overview of Construction Professional Practice in India, Total Construction Project Cycle and Role of Professionals in Construction Projects, Various Consultants involved in Projects, Managing Consultants, Tendering and Contracts Management, Role of Engineer contractor and employer in Contract Management, Project site Administration and Control, Various Laws related to construction. Project cost estimation, rate analysis, overhead charges, bidding models and bidding strategies. Qualification of bidders. Tendering and contractual procedures, Indian Contract Act1872, Definition of Contract and its applicability, Types of contracts, International contracts, Conditions and specifications of contract. Contract administration, Claims, compensation and disputes, Dispute resolution techniques, Arbitration and Conciliation Act 1996, Arbitration case studies, Professional ethics, Duties and responsibilities of parties.

# **References :**

1. Patil B.S., Building and Engineering Contracts, 5th Edition, Patil, Pune, 2005.

2. Avtar Singh, Law of Contract, Eastern Book Company, Lucknow, 1993.

3. FIDIC, Condition of Contract for works of Civil Engineering Construction Part I – General Conditions with Forms of Tender and Agreement (Red Book), FIDIC, Switzerland, 1998.

4. Construction Jobsite Management - William R. Mincks, Hal Johnston Walker A., Project Management in Construction, (4th Ed.), Blackwell Publishing, London, 2002.

5. Total Construction Project Management, George J. Ritz, McGraw Hills 1994,

6. Bids, Tenders& Proposals, Herald Lewis, Kogen Page

# CM(PE)-23012 Design of Underground Structures

# Teaching Scheme

Lectures: 3 Hrs/ week

Examination Scheme T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Comprehend the design aspects of various underground structures in soil and rockmass

**CO 2:** Identify the excavation methods for construction of underground structures in different ground conditions

**CO 3:** Analyze the underground structures in rock and soil using elastic and elastoplastic solutions

**CO 4:** Appraise the underground structure using empirical, observational, analytical and numerical approaches

**CO 5:** Design the support and safety system for underground structures

# Syllabus Content:

Introduction: Introduction to underground space and tunnelling, History, Tunnelling challenges, Types and classification of underground opening, Factors affecting design, Design methodology, Functional aspects, Size and shapes, Support systems, Codal provisions

Excavation Method and Machinery: Drilling and Blasting for Underground and Open Excavations, blast operation planning, Explosive products, Blast Design, controlled Blasting techniques, Blasting damage and control, safe practices with explosives and shots. Tunnel driving techniques, TBM techniques, Bottom up and bottom down method, Tunnelling in difficult ground condition, Underground supports, theory of arching, rock loads and loads on tunnel linings, Safety aspects, Case histories.

Analysis And Design of Underground Openings: Analysis of Underground openings, stresses around different shapes, initial state of stresses, Closed form solutions, BEM, FEM, Design based on analytical methods, Empirical methods based on RSR, RMR, Q systems, Observational method- NATM, Convergence-confinement method, Design based on Wedge failure and key block analysis, Design of Shafts and hydraulic tunnels.

Design Of Support System: Tunnel support systems, Different type of supports, Standup time, Ground Reaction Curve, Stability of excavation face and Tunnel portals, Surface settlement due to underground works, Ground subsidence study, Use of appropriate software packages, Shotcreting including some case histories, Underground instrumentation and monitoring

Tunnel Health and Safety Issues: Construction methods, Ventilation, De-watering, Control and monitoring system: services, operations and maintenance, Lighting: specifications, maintenance, emergency lighting, Power supply and distribution, Water supply and distribution, Safety provisions, Localized hazards, Fire hazards in highway tunnels, Rapid transit tunnels. Surveillance and control system for highway tunnels. Tunnel finish, Rehabilitation: Inspection methods, Repairs, Tunnel construction contracting.

# **References :**

1. Ramamurthy T., "Engineering in Rocks for Slopes, Foundation and tunnels", Prentice Hall of India Pvt Ltd, New Delhi, 2010.

2. Kolymbas, D., "Tunneling and tunnel mechanics: A rational approach to tunnelling", Springer Publications. 2008.

3. Goodman, R. E., "Introduction to Rock Mechanics", John Wiley & Sons, 1989.

4. Hoek, E. and Brown, E. T., "Underground excavations in rock", The Institute of mining and metallurgy. 2005.

5. Brady, B. H. G. and Brown, E. T., "Rock mechanics for underground mining", Springer Publication, 2006.

6. Obert, L. and Duvall, W.I., "Rock mechanics and the design of structures in rock", John Wiley and Sons, 1967.

7. Chapman D, Metje, N and Stark A, "Introduction to tunnel construction", Spon Press, Taylor and Francis, 2010.

# CM(PE)-23013 Environmental Impact Assessment

Teaching Scheme

Lectures: 3 Hrs/ week

Examination Scheme T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Comprehend the ecological stability and ecological systems concept and formulate the real problem due to manmade developmental activities

**CO 2:** Evaluate Environmental, Economic and social indicators

**CO 3:** Analyze the Environmental, Economic and social indicators.

**CO 4:** Formulate appropriate technique and methodology to carry out Environmental Impact Assessment.

# Syllabus Content:

Environment and its interaction with human activities – Environmental imbalances, attributes, impacts, Indicators and Measurements,

Environmental Impact Assessment (EIA) – concepts, objectives of EIA, advantages and limitations of EIA, Screening and scooping, Rapid EIA and comprehensive EIA Environmental Indicators – Indicators of climate, Indicators of terrestrial subsystems, Indicators of aquatic subsystems, Selection of indicators,

Socio – economic indicators – basic information,

Indicators for economy – social indicators, Indicators for health and nutrition,

Cultural indicators – selection Methodologies for carrying Environmental Impact Assessment – Overview of methodologies,

Environmental risk analysis - Adhoc, Checklist, Matrix, Network, Overlays, Fault free analysis, Benefit Cost Analysis, Choosing a methodology, Review criteria, Case studies on EIA Environmental issues in water resources development – Land use, soil erosion, their long term and short term effects, Disturbance and long term impacts, Changes in quantity and quality of flow, Environmental impact assessment of water resource development structures – Case studies

Water Quality Impact Assessment – attributes, Water Quality Impact Assessment of Water Resources Projects, Data requirements of water quality impact assessment for dams, Impacts of dams on environmental, Case studies Environmental Issues in Industrial Development – On-site and Off-site impacts during various stages of industrial development, Long term climatic changes, Greenhouse effect, Industrial effluents and their impact on natural cycle, Environmental impact of Highways, Mining and Energy development

- 1. Jain R.K., Urban L.V. and Stracy G.S. "Environmental Impact Analysis", Van Nostrand Reinhold Co. New York
- 2. Rau J.G. and Wooten D.C. "Environmental Impact Assessment", McGraw Hill Publications Co. New York
- 3. UNESCO "Methodological Guidelines for the Integrated Environmental

# Evaluation of Water Resources Development", WNESCO/UNEP, Paris

4. Canter L.W. "Environmental Impact Assessment", McGraw Hill Pub. Co. New York

# CM(PE)-23016 Artificial Intelligence and Machine Learning Applications for Construction Management

Teaching Scheme Lectures: 3 Hrs/ week Examination Scheme T1 and T2 - 20 marks each End Sem. Exam. - 60 marks

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Analyze components of Instance-Based Learning, explaining KNN and variants. **CO 2:** Implement Decision Tree construction, recognizing overfitting and applying pruning.

**CO 3:** Evaluate Linear and Non-Linear Support Vector Machines, with a focus on multiclass classification.

**CO 4:** Assess Outlier Mining techniques, differentiating between statistic-based, distance-based, and density-based methods

**CO 5:** Design Ensemble Learning methods (Bagging, Boosting, etc.) and propose strategies for handling class-imbalanced data.

# Syllabus Content:

Introduction to data mining: What is data mining, Data mining functionality, Data Mining Techniques, Data pre-processing: techniques of preprocessing data, including data cleansing, Data integration, data reduction, and transformation.

Instance based learning: Overview of IBL, three components of KNN and two Variants of kNN.

Decision trees: Decision tree representation, Construct Decision Tree, Overfitting and Tree Pruning, Pros and Cons of DTs, Decision Tree Representation

Support vector machine: Linear Support Vector Machine and non-Linear Support Vector Machine, multiclass classification, support vector regression.

Outlier mining: Background of Outlier Detection, three techniques to detect outliers, including statistic-based method, distance-based method, and density-based method. Ensemble leaning: General Idea of Ensemble Methods, Several classical ensemble methods, including Bagging, boosting, Cross validated Committees, and random forests. Generation of members and combining schemes in general. Besides, techniques to improve the classification performance for class-imbalanced data.

- 1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, Morgan Kaufmann, 3rd edition, 2011.
- 2. Ian H.Witten, Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations, San Francisco: Morgan Kaufmann Publishers, 3rd ed. 2011.
- 3. Charu C. Aggarwal, Data Mining: The Textbook, Springer, May 2015.

- 4. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson, 1st Edition, 2005.
- 5. Christopher M. Bishop, Pattern recognition and machine learning, the Morgan Kaufmann series in information science and statistics, Springer Science, 2006.

# ML-23001 Research Methodology and Intellectual Property Rights

# **Teaching Scheme**

Lectures: 2 Hrs/ week

Examination Scheme T1 and T2 -20 marks each End Sem. Exam.- 60 marks

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Analyze research problems and ethical research practices

CO 2: Apply research methodology and enhance presentation skills

**CO 3:** Apprehend the importance of Intellectual Property Rights in engineering

**CO 4:** Explore the role of IPR in national wealth and global market leadership

**CO 5:** Evaluate national and international IP systems as incentives for innovation and economic growth.

# Syllabus Content:

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.

Effective literature studies approaches, analysis, Use Design of Experiments /Taguchi Method to plan a set of experiments or simulations or build prototype, Analyze your results and draw conclusions or Build Prototype, Test and Redesign

Plagiarism, Research ethics, Effective technical writing, how to write report, Paper, Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee Introduction to the concepts Property and Intellectual Property, Nature and Importance of Intellectual Property Rights, Objectives and Importance of understanding Intellectual Property Rights

Understanding the types of Intellectual Property Rights: -Patents-Indian Patent Office and its Administration, Administration of Patent System – Patenting under Indian Patent Act, Patent Rights and its Scope, Licensing and transfer of technology, Patent information and database. Provisional and Non Provisional Patent Application and Specification, Plant Patenting, Idea Patenting, Integrated Circuits, Industrial Designs, Trademarks (Registered and unregistered trademarks), Copyrights, Traditional Knowledge, Geographical Indications, Trade Secrets, Case Studies

New Developments in IPR, Process of Patenting and Development: technological research, innovation, patenting, development, International Scenario: WIPO, TRIPs, Patenting under PCT.

- 1. Aswani Kumar Bansal : Law of Trademarks in India
- 2. B L Wadehra : Law Relating to Patents, Trademarks, Copyright, Designs and Geographical Indications.
- 3. G.V.G Krishnamurthy : The Law of Trademarks, Copyright, Patents and Design.
- 4. Satyawrat Ponkse: The Management of Intellectual Property.

- 5. S K Roy Chaudhary & H K Saharay : The Law of Trademarks, Copyright, Patents
- 6. Intellectual Property Rights under WTO by T. Ramappa, S. Chand.
- 7. Manual of Patent Office Practice and Procedure
- 8. WIPO : WIPO Guide To Using Patent Information
- 9. Resisting Intellectual Property by Halbert , Taylor & Francis
- 10. Industrial Design by Mayall, Mc Graw Hill
- 11. Product Design by Niebel, Mc Graw Hill
- 12. Introduction to Design by Asimov, Prentice Hall
- 13. Intellectual Property in New Technological Age by Robert P. Merges, Peter S. Menell, Mark A. Lemley
- 14. Stuart Melville and Wayne Goddard, "Research methodology: An Introduction for Science and Engineering Students", Juta and Company Ltd.
- 15. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta and Company Ltd, 2004
- 16. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications, 2 nd edition, 2005

# ML-23002 Effective Technical Communication

Teaching Scheme Lectures: 1 Hrs/ week Examination Scheme

100 Marks (4 Assignments-25 Marks each)

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Create effective dialogue for business-related situations

**CO 2:** Apply listening, speaking, reading, and writing skills for communication purposes, utilizing functional grammar and vocabulary effectively.

CO 3: Critically analyze different concepts and principles of communication skills

**CO 4:** Demonstrate productive skills and proficiency in structured conversations.

**CO 5:** Appreciate, analyze, and evaluate business reports and research papers.

# **Syllabus Content:**

7 Cs of communication, common errors in English, enriching vocabulary, styles and registers, Aural-Oral Communication, The art of listening, stress and intonation, group discussion, oral presentation skills, Reading and Writing, Types of reading, effective writing, business correspondence, interpretation of technical reports and research papers

- 1. Raman Sharma, "Technical Communication", Oxford University Press.
- 2. Raymond Murphy "Essential English Grammar" (Elementary & Intermediate) Cambridge University Press.
- 3. Mark Hancock "English Pronunciation in Use" Cambridge University Press.
- 4. Shirley Taylor, "Model Business Letters, Emails and Other Business Documents" (seventh edition), Prentise Hall
- 5. Thomas Huckin, Leslie Olsen "Technical writing and Professional Communications for Non-native speakers of English", McGraw Hill.

# **Coursre curricular Activity (Liberal Learning Course)**

# Teaching Scheme

Lectures: 1 Hrs/ week

Examination Scheme T1 and T2 -End Sem. Exam.

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Develop capacity to understand multidisciplinary sciences in a friendly manner. **CO 2:** Create openness to diversity.

**CO 3:** Acquire ability to lead and examine life and value the need for life learning **CO 4:** 

<u>CO 4.</u> CO 5:

# Syllabus Content:

Student will be able to choose and enhance practical learning and application in the subject of his/her choice. One credit course spread over the semester to enhance practical learning and application.

- Agriculture
- Business
- Clay Art & Pottery
- Corporate Culture
- Defense
- French
- Geography
- Holistic Health
- Modern Film Making
- Music (Instrumental)
- Photography
- Political Science
- Music (Vocal)
- Wood and Metal Art
- Japanese
- Painting

# CM(PE)-23017 Road Safety and Road Safety Audit

Teaching Scheme Lectures: 3 Hrs/ week Examination Scheme T1 and T2 -20 Marks each End Sem. Exam.-60 Marks

**Course Outcomes:** At the end of the course, the students are able to:

**CO 1:** Define key aspects of road accidents, distinguish accidents from crashes, and recall elements of road safety plans.

**CO 2:** Explain the impact of human factors on road safety, analyze planning considerations, and comprehend crash reconstruction principles and statistical analysis of accidents.

**CO 3:** Utilize road safety engineering principles for designing safe road links and junctions, apply statistical analysis to predict accidents, and use crash data for hazard identification.

**CO 4:** Evaluate economic aspects of accidents, analyze road safety audits, and critically assess crash locations through diagnostic processes and data interpretation.

**CO 5:** Assess the effectiveness of road safety strategies, before-after methods in crash analysis, and critically evaluate statistical models related to accidents and road safety audits.

# Syllabus Content:

Introduction: Road traffic accidents scenario in India, characteristics of accidents, accident vs. crash, effect of human factors, planning for road network, land use and road environment for safety, designing for road safety - links and junctions, road safety engineering, road safety improvement strategies, elements of a road safety plan.

Crash investigation and analysis: Steps in treatment of crash locations, diagnosing crash problem and solutions, accident report form, storing of data, using and interpreting crash data, identifying and prioritizing hazardous locations, condition and collision diagrams; Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled; Crash reconstruction: understanding basic physics, calculation of speed for various skid, friction, drag, and acceleration scenarios.

Statistical analysis of accidents: Descriptive statistics, confidence interval, hypothesis testing, models related to accident frequency, accident severity, accident duration, various methodological issues - over/under dispersion, time-varying explanatory variables, unobserved heterogeneity, endogeneity, under-reporting, spatial and temporal correlation, etc; Accident prediction model.

Before -after methods in crash analysis: Before and after study, before and after study with control sites, comparative parallel study, before, during and after study, Empirical Bayes method.

Economic analysis of accidents: Accident costing-economic appraisal, EUAC, PWOC, B/C ratio, IRR, NPV.

Road Safety Auditing: An Introduction, Concept and need of Road Safety Audit (RSA). Procedures in RSA, design standards, audit tasks, stages of road safety audit, Road Safety Audit Types, key legal aspects, process, audit team and requirements, Checklist, how to use Checklists Road Safety inspection. Road design issues in RSA's. Overview of Road Safety Hazards. Report writing including deficiency identification, corrective actions recommendations, prioritisation. Structuring RSA report. Hazard Identification and Management, Risk Assessment & Prioritization of audit recommendations. Performing planning & design stage road safety audit, pre-opening & existing stage of safety audit, assessing factors responsible for deciding/ relocating the road alignment, before/ after analysis as a case study, Introduction to Construction Stage Road Safety Audits, Performing Construction Stage Safety Audits on Urban Roads, Safety at Construction Site: Safety provisions for workers at construction site, Construction Zone markings, standard barricading and work zone signage & marking plan.

- 1. IRC SP 88- 2019 Road Safety Audit Manual (Second Revision)
- 2. IRC SP 55 2015 Work Zone Traffic Management
- 3. Highway Safety Manual by Transportation Research Board
- 4. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publications
- 5. Babkov, V.F. `Road conditions and Traffic Safety', MIR publications, 1975.
- 6. K.W. Ogden, `Safer Roads A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.
- 7. Khanna and Justo , 'Highway Engineering', Nem Chand & Brothers, Roorkee.
- 8. Pignataro, Louis, `Traffic Engineering Theory and Practice', John Wiley.
- 9. RRL, DSIR, `Research on Road Safety', HMSO, London.
- 10. Papacoastas, 'Introduction to Transportation Engineering' Prentice.

# **CM-23012 Mini Project**

Teaching Scheme

Practical : 1 Hrs/ week

**Examination Scheme End Sem. Exam.** - 100 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Recognize the topic for study and carry out literature survey.

**CO 2:** Write a technical report related to selected topic

**CO 3:** Present outcome of the study with the help of ppt.

**CO 4:** Develop technical writing and communication skills

#### Syllabus Contents:

Mini project presentation is to be performed and reported by the end of the second semester.

# **CM-23011** Construction Management Laboratory III

**Teaching Scheme Practical:** 4 Hrs/ week

**Examination Scheme** End Sem. Exam. - 100 marks

**Course Outcomes:** At the end of the course, the students is able to:

**CO 1:** Illustrate the use of various software related to construction management

**CO 2:** Evaluate projects, prepare and present technical report

**CO 3:** Analyse and apply solution for complex problems using advanced software

**CO 4:** Formulate software applications for complex problems

#### Syllabus Contents:

Student will do various exercise related with Construction Projects Planning and Management (CPPM) using software like Primavera, M-S Project, Revit, Neviswork, Esite, SPSS, MSP, TORA and other software.

Students will carry out various assignments related to the courses taught in this semester given by the faculty teaching courses.

Students will carry out field visits.

# **Dissertation I**

**Teaching Scheme** 

Examination Scheme Mid Sem. Exam. - 40 marks End Sem. Exam. - 60 marks

# **Course Outcomes**

At the end of course, Students will be able to

- 1. Identify and carry out research in key areas of Transportation Engineering
- 2. Analyze data collected and interpret the same

3. demonstrate the evidence of understanding of the chosen topic area, and presentation of technical information.

4. Use and develop written and oral presentation skills

# Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the academics and the practice. The student should complete the following:

- 1. Literature survey
- 2. Problem Definition
- 3. Motivation for study and Objectives
- 4. Data collection / experimental work
- 5. Report and presentation

# **References:**

1. Various books, research papers, patents and IPRs on the topic selected for the dissertation.

# **Dissertation II**

Teaching Scheme

Examination Scheme Mid Sem. Exam. - 40 marks End Sem. Exam. - 60 marks

# **Course Outcomes**

At the end of course, Students will be able to

1. Synthesize knowledge and skills previously gained and applied to in-depth study and execution of new technical problem.

2. Capable to select from different methodologies, methods and forms of analysis suitable to research problem and justify it.

- 3. Ability to present the findings of their technical solution in a written report.
- 4. Develop conclusions based on the analysis which are useful to the society at large
- 5. Write a technical report related to selected topic

6. Present outcome of the study with the help of presentation

# **Syllabus Contents:**

M. Tech. project is aimed at training the students to analyze independently any problem in the field of Transportation Engineering. The project may be analytical, computational, experimental or a combination of three. The project report is expected to show clarity of thoughts and expression, critical appreciation of the existing literature and analytical, experimental, computational aptitude. The student progress of the dissertation work will be evaluated in stage II by the departmental evaluation committee and final viva voce will be conducted by the external examiner.

# **References:**

1. Various books, research papers, patents and IPRs on the topic selected for the dissertation.