Draft of Proposed Course Structure
for Post Graduate Degree Programme

M. Tech. in Civil Engineering
with Specialization in
Infrastructure Engineering and Management

Presented to Academic Council
on 15 April 2017

Dr. Babasaheb Ambedkar Technological University
Lonere 402 103, Dist- Raigad, Maharashtra, INDIA
Program Objectives

Goal of the Civil engineering with a specialization in Infrastructural Engineering Management (IEM) at Dr. Babasaheb Ambedkar technological University, Lonere (BATU) is to provide students with preparation to become worthy of professional careers in the field and to be motivated for lifelong learning. All prescribed courses have definite objectives and outcomes. Program objectives are expected qualities of engineers as under:

a) Preparation: To prepare students to excel in various educational programmes or to succeed in industry / technical profession through further education/training;

b) Core Competence: To provide students with a solid foundation in mathematical, scientific fundamentals required to solve E&T related problems;

c) Breadth: To train students with a breadth of scientific knowledge to comprehend, analyze, design & create novel products and solutions for real life problems;

d) Professionalism: To inculcate in students professional/ethical attitude, effective team work skills, multidisciplinary approach and to relate engineering issues to a broader context;

e) Learning Environment: To provide students with academic environment of excellence, leadership, ethical guidelines and life-long learning needed for a long / productive career.

In addition to above DBATU graduate is expected to be

1. Taking pride in their profession and have commitment to highest standards of ethical practices,

2. Able to design structural system that is safe, economical and efficient.

3. Capable of using modern tools efficiently in all aspects of professional practices.

4. Dealing successfully with real life civil engineering problems and achieve practical solutions based on a sound science and engineering knowledge.

5. Shall represent the highest standards of Structural engineering and related technical disciplines.

6. Shall be engage in continuous research, development and exchange of knowledge for professional development.

7. Be honest in their control and performing their duties and promote effective use of resources through open, honest and impartial services to the public.

8. Act in such a manner which will uphold the honour, integrity, or dignity of the engineering profession, and avoid knowingly engaging in business or professional practices of a fraudulent, dishonest or unethical nature.

9. Recognize that the lives, safety, health and welfare of the general public are dependent upon engineering, decision and practices.

10. Continue their professional development throughout their careers and provide opportunities for the professional development.

11. Consistently and successfully apply Fundamental Structural Engineering principles within their chosen engineering application area.
## First Semester

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<tr>
<th>Sr. No.</th>
<th>Subject Code</th>
<th>Name of Subject</th>
<th>Hours /Week</th>
<th>Credit</th>
<th>Examination Scheme</th>
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<tr>
<td>01</td>
<td>CVIEM101</td>
<td>Infrastructure Planning</td>
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<td>02</td>
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<td>CVIEM103</td>
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<tr>
<td>05</td>
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**Elective-I**

CVSE-E1/01: Building Environment and Services

CVSE-E1/02: Ports and Harbour Structures

**Elective-II**

CVSE-E2/01: Highway Infrastructure

CVSE-E2/02: Contracts, Administration and Arbitration

CVSE-E2/03: Operation Research
## Second Semester

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject Code</th>
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<th>Hours /Week</th>
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<td>01</td>
<td>CVIEM201</td>
<td>Construction Equipment Management</td>
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<td>02</td>
<td>CVIEM202</td>
<td>Infrastructure Development</td>
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<td>CVIEM-S01</td>
<td>Seminar-I</td>
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<td>CVIEM-L02</td>
<td>PG Lab-II or Mini -Project</td>
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**Elective-III**
- CVSE-E3/01: Environment & Energy Management
- CVSE-E3/02: Value Engineering and Valuation

**Elective- IV**
- CVSE-E4/01: Resource Management
- CVSE-E4/02: Urban Hydrology and Storm Water Management

**Elective-V (Open)**
- CVSE-E5/01: Safety Management in Construction
- CVSE-E5/02: Research Methodology
## Third Semester

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<td>CVIEM301</td>
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## Fourth Semester

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**GRAND TOTAL**

1700

*Evaluation at the end of semester*
Semester I
CVIEM101 Infrastructure Planning

Teaching Schemes: 3 Lect. + 1 Tut hrs./week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Infrastructure
Definitions of infrastructure, Governing Features, Infrastructure organizations & Systems, Overview of Infrastructure development in India - Power Sector, Water Supply and Sanitation Sector, Transportation, Urban and Rural (06 Lectures)

Module 2: Infrastructure Planning
Planning and appraisal of major infrastructure projects, Infrastructure Project budgeting and funding, Regulatory Framework, Sources of Funding, Procurement strategies, Scheduling and management of planning activities, Screening of project ideas (07 Lectures)

Module 3: Financial management
Inflation - depreciation, taxes, Personnel cost, Equipment costs, overheads. Time value of money, Investment criteria, Project cash flows – elements and basic principles of estimation, Financial estimates and projections, Cost of capital, Rate of return, Project risk analysis, Life cycle analysis (08 Lectures)

Module 4: Challenges
Challenges in Construction and Maintenance of Infrastructure, Multi-criteria analysis for comparison of infrastructure alternatives, Political and social perspectives of infrastructure planning, Procurement strategies, Efficient use of resources, Mapping and Facing the Landscape of Risks in Infrastructure Projects (07 Lectures)

Module 5: Economic Analysis
Concepts and Applications, Principles of methodologies for economic analysis of public works, Social welfare function, indifference curves and tradeoffs, Demand curves and price elasticity’s. (07 Lectures)

Module 6: Evaluation Techniques
Net present value method, Benefit-cost ratio and internal rate of return, Shadow pricing; Accounting for risk and uncertainty (07 Lectures)

Guidelines for Assignments: Minimum Six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of minimum Three Modules.

References:
Outcomes:
Upon completion of the course, the student will be able to:

CVIEM102 Life Cycle Cost Analysis of Infrastructures

Teaching Schemes: 3 Lect. + 1 Tut hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Introduction
Background, Definition of Life Cycle costing, Uses of Life Cycle costing, Implementation of LCC, Aim and Objectives, Economic Indicators (06 Lectures)

Module 2: Data requirements
Introduction, LCCA Parameters, Discounting-related data, Real Discount Rate, Constant Dollars/INR, Present Value, Salvage Value, Residual Value, Discount Rate, Discount Formula & Discount Factors, Cost and time data – Analysis/Study Period, Rehabilitation Timings, Other data requirements - Discounting & Inflation in LCC Analysis, Mathematical modeling: Introduction, LCC decision rules, Mathematical LCC models (08 Lectures)

Module 3: Cost Estimates

Module 4: Supplementary Measures
LCC Methods, Net Savings, Saving to Investment Ratio (SIR), Adjusted Internal Rate of Return(AIRR), Simple Payback And Discounted Payback, Break even analysis, Benefit cost analysis, Payback period analysis, Present worth analysis, Equivalent annual cost analysis (07 Lectures)

Module 5: Aspects of Implementation
Introduction, Stages of implementation, Logic of implementation, Cost break down structure, WLC software (07 Lectures)

Module 6: Uncertainty and risk assessment
Introduction, The sensitivity analysis, Deterministic & Probability-based techniques, the fuzzy approach, The integrated approach (07 Lectures)

Guidelines for Assignments: Minimum six assignments consisting theoretical as well as numerical aspects of the course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover syllabus of any three Modules.

References:
- Ashworth A, Cost studies of buildings, Longman
- Byrne P, Risk, uncertainty and decision-making in property development, E & F N Spon, London
Outcomes:
Upon completion of the course, the student will be able to:

CVIEM103 Construction Management Practices

Teaching Schemes: 3 Lect. + 1 Tut hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Management
Traditional, modern scientific management, Principles and functions of management, Management Styles with special focus on the contributions of Taylor, Fayol, Mayo, McGregor, Weber, Gilbreth. Introduction to project planning, scheduling, methods of scheduling, controlling. Job layout work break down structure, LOB technique. Role of planning department in construction project

Module 2: Network techniques
Construction management network schedule, rules and advantages of networks, Precedence Network Analysis, different software in Construction scheduling (MSP, Primavera, Construction manager) and their applications, Advantages and applications of precedence networks

Module 3: Construction scheduling
Advance level applications of Networks techniques like Gantt chart, milestone chart, CPM, PERT, Mass haul diagrams, objectives, means and importance of cost control

Module 4: Project Controlling
Monitoring and Control of construction project, Network Crashing, Resource constrained scheduling, Resource Leveling and Smoothening, Project Updating, Non-linear cost time trade off, Project updating – methods of updating, Site layout and mobilization

Module 5: Cost optimization
Project cost formulation, Optimization of cost through network contraction, linear programming and Project life cycle cost

Module 6: Work Study
Definition, Objectives, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, and 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

Guidelines for Assignments: Minimum Six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of any Three Modules.

References:
Outcomes:
Upon completion of the course, the student will be able to:

Elective I

CVIEM-E1/01 Building Environment and Services

Teaching Schemes: 3 Lect. hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Acoustics and lighting
Acoustical Designs, Noise and its control, Natural and artificial Light in Building, Lighting, Measurement, Design of Lighting system (07 Lectures)

Module 2: Energy conservation in Buildings
Thermal properties of buildings, Thermal insulation and insulating material, Thermal design of enclosures, Thermal environment inside building, cooling & heating loads, Centralized Systems of air-conditioning (07 Lectures)

Module 3: Electrical services
Electric wiring system in building, conductor, cable & conduits, Elevators, Escalators and conveyer, Design, Type, Location, bye-laws etc. (07 Lectures)

Module 4: Water supply systems
Domestic and commercial Hot water and water supply system for multi-storeyed buildings, Swimming pools-Design criteria, Springboards, pressure filters for recirculation, maintenance
Drainage system: Nature of Drainage phenomenon, Ant siphon & vent piping - Installation, pipe joinery, External drainage System in building. Design aspects of Sewage Treatment Plants  

Module 5: Fire Fighting in Buildings  
Controlling features in architectural planning Norms for fire prevention and mitigation measures, Fire rating of materials, Fire control devices

Module 6: Other services and approvals  
Gas services & distribution piping, Roof water harvesting & water conservation, Approval of authorities for water supply

Guidelines for Assignments: Minimum Six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of any Three Modules.

References
- National Building code, Bureau of Indian standard
- Acoustical designing in Architecture, by V.O.Kusen & C.M.Harris, John.Wiley&Son
- Architecture acoustics, by Anita Lawrence.
- Main climae & architecture  B.Govoni, Elsvire Publishing co.
- Functional requirement of building (other than Industrial Building) ,BIS Handbook

Outcomes:
Upon completion of the course the students will be able to:

Elective I  
CVIEM-E1/02 Ports and Harbour Structures

Teaching Schemes: 3 Lect. hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Introduction  
Ports and harbours as the interface between the water and land infrastructure – an infrastructure layer between two transport media.

The Fundamentals: Wave conditions inside harbour, water circulation; breakwaters, jetties & quay walls; mooring, berthing and ship motion inside the port; cargo handling – bulk material storage & handling.

Module 2: Design Issues  
Sea port layout with regards to (1) wave action (2) siltation (3) navigability berthing facilities

Module 3: Design of Port Infrastructures  
Design of port infrastructures with regards to (1) cargo handling (2) cargo storage (3) integrated transport of goods, planning multipurpose port terminals

Module 4: Port Operations
Allowable wave conditions for cargo handling, wave conditions for human safety on quays and breakwaters, forecasting/nowcasting of wave & current conditions for port operations, dredging and navigability, hazard scenarios; VTMS & management of computerized container terminal, safety & environment (handling of fire, oil spill, rescue, etc.).

**Module 5: Inland Waterways and Ports**
Maintenance of waterways, construction of environmentally engineered banks, dredging, processing and storing of polluted dredged materials, development of river information services

**Module 6: Construction Aspects**
Planning and construction of expansion and renovation of existing Inland Port Infrastructure, Sustainability: Global trade and port structuring/reforms, impact of possible climate change scenarios, sustainable development strategies for cities and ports

**Guidelines for Assignments:** Minimum six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

**Guidelines for Class Test:** Class Test shall cover Syllabus of any Three Modules.

**References:**
- Pera Bruun, “Port Engineering”, Gulf Publishing Company

**Outcomes:**
Upon completion of the course the students will be able to:

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**Elective II**

**CVIEM-E2/01 Highway Infrastructure**

**Teaching Schemes:** 3 Lect. hrs/week; **Evaluation Scheme:** Theory: 60; Mid-semester Exam 20; Class Assessment 20

**Course Contents**

**Module 1: Introduction and planning**
Roll of transport in modern society and in countries economy, modes of transport and their characteristics, need for transport planning, goals and objectives, transportation planning process - stages in transport planning - inventories, trip generation, trip distribution, modal split, and traffic assignment. Scope of highway infrastructure, Road development plans, Recent developments – NHAI, NHDP, PMGSY, MSRDC, Highway finance –BOT, BOT, Annuity, PPP, DBFO.

**Module 2: Highway project preparation**
Importance of surveys and investigation, types, traffic surveys-classified volume count, traffic growth rate, axle load surveys, speed and delays surveys, origin and destination surveys, Conventional ground surveys, alignment and root locations, drainage studies, soil and pavement design investigations

**Module 3: Traffic Engineering and Highway Geometric Design**
Traffic characteristics, traffic studies and analysis, traffic control devices, road marking, traffic sign, traffic signal, intersections, Terrain classification, Highway Alignment-Definition, requirements, factors controlling alignment, alignment of hill roads. Cross-sectional elements, sight distances, concept of level of service, PCU, parking studies, accident studies and highway safety. Highway Drainage: Necessity, surface and subsurface drainage, maintenance and repairs

**Module 4: Pavement design**


**Module 5: Reinforced earth Structures**

Reinforced earth structures to improve bearing capacity and stability of embankment slopes, Types and applications of geosynthetic reinforcements, Bearing, Internal and external stability of reinforced earth structures, Reinforcing of earth using geosynthetics, soil nailing (SNART) to protect land sliding, Waste utilization with reinforcements in road and rail track embankment fill

**Module 6: Highway economics and finance**

Methods of highway finance, economical and financial evaluation of project, distinction between economic and financial analysis, commonly used terms in economic and financial analysis, total transportation cost, shadow pricing, treatment of inflation, methods of economic evaluation. Net present value (NPV), internal rate of return method, benefit cost ratio method, stages in economic evaluation, P P P Model Highway Project

**Guidelines for Assignments:**

- Minimum Six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

**Guidelines for Class Test:** Class Test shall cover Syllabus of any Three Modules.

**References:**

- Annual on Economic Evaluation of Highway Projects in India.
- Foundation Engineering by P.C. Varghese, Prentice Hall of India.
- Foundation Analysis and Design by J.E.Bowles, Mc Graw Hill

**Outcomes:**

Upon completion of the course the students will be able to:

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**Elective II**
Introduction:

CVIEM-E2/02 Contracts, Administration and Arbitration

Teaching Schemes: 3 Lect. hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Contracts Administration
The standard forms of building contracts, the rights of building owners, adjoining owners and third parties. The Indian Contract Act (06 Lectures)

Module 2:

Module 3: Time of Performance
Provisions of contract law – Breach of contract. Contracts for projects under International AID (07 Lectures)

Module 4: Industrial Act and Labour Laws
Industrial Dispute Acts, payment of wages act, Minimum Wages Act, Indian Trade Union Act, and Workmen’s Compensation Act (07 Lectures)

Module 5: Arbitration of Engineering Contracts
Indian Arbitration Act, arbitration agreement, conduct of arbitration, power and duties of arbitrator, rules of evidence/ preparation and publication of awards, methods of enforcement, impeding and award. Limitations of arbitration in the Indian context, Dispute resolving boards-necessity, formation, functioning advantages (08 Lectures)

Module 6: Administration of Incentive schemes
Necessity, merit rating, Job evaluation installation, modification and maintaining, incentive scheme based on implementation experience (06 Lectures)

Guidelines for Assignments: Minimum Six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of any Three Modules.

References:

- “Codes of Practice and Standard Specifications” of AP PWD., CP WD, MES etc, Anupbhai Publications,
- “Professional Practice” by Roshan Namavat”, published by Anupbhai Publications.
- "Latest Amendments to latest versions of Building Bye-Laws and Engineering Contract Laws”.
- “Estimating and Costing” by B. S. Patil (Vol 1 & 2).
- Construction contracts and claims – Simon M.S. (McGraw Hill, New York)
- Construction Contract Management-NICMAR publication
- Handbook of estimating & costing for Quantity Surveyors - P. T. Joglekar

Outcomes:

Upon completion of the course the students will be able to:

Elective II
**Teaching Schemes:** 3 Lect. hrs/week; **Evaluation Scheme:** Theory: 60; Mid-semester Exam 20; Class Assessment 20

## Course Contents

**Module 1: Introduction to Operations Research**
* (07 Lectures)

**Module 2: Linear Programming**
Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method, Penalty Cost Method or Big M-method, Two Phase Method, Sensitivity Analysis  
* (07 Lectures)

**Module 3: Transportation Problem**
Formulation, solution, unbalanced Transportation problem, finding basic feasible solutions – Northwest corner rule, least cost method and Vogel’s approximation method. Optimality test: the stepping stone method and MODI method  
* (07 Lectures)

**Module 4: Integer Programming Problem**
Introduction, Types of Integer Programming Problems, Gomory’s cutting plane Algorithm, Branch and Bound Technique, Introduction to Decomposition algorithms  
* (07 Lectures)

**Module 5: Simulation**
* (07 Lectures)

**Module 6: Game Theory**
Competitive games, rectangular game, saddle point, minimax, maximin method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games  
* (07 Lectures)

**Guidelines for Assignments:** Minimum Six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

**Guidelines for Class Test:** Class Test shall cover Syllabus of any Three Modules.

**References:**
- Hamdy A. Taha, “Operations Research”, Pearson Publisher
- N.D.Vohra, “Quantitative Techniques in Management,” Mcgraw hill Publication
- R.Pilcher, “Principles of Construction Management”
- E.S.Buffa, “Operations Management” Wiley,India
- Hira and Gupta, “Operation Research” S.Chand Publication

**Outcomes:**
Upon completion of the course the students will be able to:
CVIEM104 Communication Skill

Teaching Schemes: 2 Lect. hrs/week; Evaluation Scheme: Class Assessment 25; Oral examination 25

Course Contents

Module 1: Language for Technical Purpose and Presentation Tools
Technical vocabulary, Sentence structures, Microsoft office, Graphical presentations
(03 Lectures)

Module 2: Formal Written Communication
Drafting Letters, e-Mails, Memos, Notices, Circulars, Schedules.
(03 Lectures)

Module 3: Project Research Proposals and Reports
Project Report: Types of reports, Planning a report, Collection & organization of information, Structure & style, Proofreading etc.
Writing a sample report.
(06 Lectures)

Module 4: Leadership Skill and Team Building, Working.
Leadership Skills: Leadership quality and styles, Emotional intelligence, Diplomacy and Tact and effective communication, Case studies.
Need of team, Effective teams, Group development, Roles in group, Case studies.
(06 Lectures)

Module 5: Business Meetings
Understanding role of meetings, planning meetings, developing meeting agendas, scheduling meetings, conducting meetings effectively, Taking notes and publishing minutes and concluding meetings, action plans, Demo meetings.
(06 Lectures)

Module 6: Presentation Skills
Preparation, Understanding audience, Use of presentation tools, Presentation, nonverbal techniques, handling questions, Demo presentations.
(04 Lectures)

References:
- Thomas N. Huckin and Leslie A. Olsen, Technical Writing and Professional Communication
- L. Ann Masters & Harold R. Wallace, Personal Development for Life & Work,10e,Cengage
- Learning India Private Limited,2011.

Outcomes:

PG Lab-I
CVIEM-L01

Teaching Schemes: 3 Pract. hrs/week; Evaluation Scheme: Oral 25; Class Assessment 25

Laboratory Work:
Laboratory Work shall consist of assignments in form of theoretical work / analytical work may be done with spreadsheet applications / software module / site visit reports case study of specific construction event or relevant lab experiments. Term work should consist of minimum six assignments

Semester II

CVIEM201 Construction Equipment Management

Teaching Schemes: 3 Lect. + 1 Tut hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Substructure
Digging and excavation of trenches, Grading, Special earth work excavation, Drilling and blasting techniques, Pile driving techniques, sinking wells.

Module 2: Construction Equipment and Machinery
Earthmoving Equipment Power shovels, Back hoe, Dragline, Clam shell, tunneling machine – types.

Excavating & Compacting Equipment: Scraper, Bulldozer. Smooth wheel roller sheep-foot roller – Pneumatic typed rollers (06 Lectures)

Module 3: Construction Equipment
Hoisting equipment, such as hoist winch, hoisting chains, and hooks and slings, various types of cranes –tower crane, mobile crane and derrick crane, Their characteristics, performance and safety in operation (07 Lectures)

Module 4: Hauling & Conveying Equipment
Dump trucks and dumpers, Belt Conveyors, Screw conveyor, Bucket conveyor (06 Lectures)

Module 5: Agreement and Concrete Production Equipment
Concrete mixers, truck mixers, pneumatic concrete placer, concrete vibrators. Pile Driving Equipment, Tunneling and rock drilling equipment – Pumps and dewatering equipment (07 Lectures)

Module 6: Management of Construction Equipment
Need for mechanization of construction, planning and financing construction plant and equipment, Owning and operating equipment versus hiring, planning for infrastructure mechanization equipment management, equipment maintenance and repair (08 Lectures)

Guidelines for Assignments: Minimum six assignments consisting of theoretical as well as numerical aspects of the course shall be performed by the candidate.
Guidelines for Class Test: Class Test shall cover Syllabus of any Three Modules.
References
Outcomes:
Upon completion of the course the students will be able to:

CVIEM202 Infrastructure Development

Teaching Schemes: 3 Lect. + 1 Tut hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Construction Industry
Nature, characteristics, size and structure, Role of infrastructure development in employment generation and improving of the National economy (08 Lectures)

Module 2: Infrastructure Policies and Agencies
Indian government policy, Five year plan of government, Various Agencies associated with infrastructure development in India as regards various sectors (10 Lectures)

Module 3: Status of Infrastructure in India
Roads and buildings, communication, water supply, irrigation, power energy sectors, ports and aviation, health and educational services, rural development (06 Lectures)

Module 4: Infrastructure development
Issues related with infrastructure development, Government sector management, public sector management, private sector management (10 Lectures)

Module 5: Funding and Consultant
Funding and managing infrastructure projects, role, and responsibility of project management consultants (06 Lectures)

Module 6: Project Development
BOT projects, PPP projects, related to role of government, concern Construction Company, benefits and limitations (08 Lectures)

Guidelines for Assignments: Minimum six assignments consisting theoretical as well as numerical aspects of the course shall be performed by the candidate.

Guidelines for Class Test: Class test shall cover syllabus of any three Modules.

References:
- India Infrastructure Report – Rakesh Mohan
- Infrastructure Today - Magazine
- Document of five year plans, published by Govt. of India
Outcomes:
Upon completion of the course the students will be able to:

**Elective III**

**CVIEM-E3/01 Environment & Energy Management**

**Teaching Schemes:** 3 Lect. hrs/week; **Evaluation Scheme:** Theory: 60; Mid-semester Exam 20; Class Assessment 20

**Course Contents**

**Module 1: Environment & Environmental Impact**
Concept of Environment & Environmental Impact, Environmental Impact Factors & Area of Considerations for Infrastructure project such as Airport, Highway, Power Projects, Water Related Projects (08 Lectures)

**Module 2: Measurement of Environmental & Socio Economic Impact & Other Concepts**
Natural/Physical Environmental Impacts, Social Impacts, Economic Impacts, concept of Significance Effect, Considerations of Alternatives, Short term versus Long term effects, Irreversible and Irretrievable Commitments of Resources (07 Lectures)

**Module 3: Socio Economic Impacts**
Physical, Social, Aesthetic and Economic Environment, Type of socio economic Impacts, Outline of basic steps in performing the socio economic assessment, Fiscal Impact Analysis (10 Lectures)

**Module 4: Environmental and Pollution Control Laws**

**Module 5: Energy Efficiency Projects & Financing of Energy Efficiency Projects**

**Module 6: Clean Development Mechanism Benefits for Energy Conservation Projects, Methodology & Procedure**
Methodology and Procedures for CDM, Eligibility Criteria, UNFCCC, Role of UNFCCC and Government of India (10 Lectures)

**Guidelines for Assignments:** Minimum six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

**Guidelines for Class Test:** Class Test shall cover Syllabus of any Three Modules.

**References:**
Outcomes:
Upon completion of the course the students will be able to:

**Elective III**

**CVIEM-E3/02 Value Engineering and Valuation**

**Teaching Schemes:** 3 Lect. hrs/week; **Evaluation Scheme:** Theory: 60; Mid-semester Exam 20; Class Assessment 20

**Course Contents**

**Module 1: Value engineering**
Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical, economic etc., Difference between value engineering, value analysis & value management, Habits, roadblocks, attitudes & their relevance in value engineering. Introduction, Life cycle of a Product, Definition, objectives and methodology of value Engineering, Comparison with other cost reduction techniques, unnecessary cost  
(06 Lectures)

**Module 2: Valuation**
Types of value, purposes of valuation factors affecting value, Different methods of valuation for different types of assets such as land and building, horticulture, historical places, Valuation Report: Valuation Report, contents, standard formats, Case study of any one Report  
(06 Lectures)

**Module 3: Job Plan**
Definition & Terms related to Value Engineering Job Plan, Various versions of job plan, Phases involved in job plan- General, information, function, creation/speculation, evaluation, investigation, recommendation and implementation.

FAST diagramming: Critical path of function, How, why and when logic, supporting and all time functions, Ground rule for FAST diagram  
(06 Lectures)

**Module 4: Function Analysis**
Function- Definition, Role of function in achieving value, Types of function, relationship between different functions in design of a Product, functional cost, functional worth, test for poor value, aim of value engineering. Function Analysis System Techniques (FAST), Graphical Function Analysis, Systematic approach, Phases of value engineering  
(06 Lectures)

**Module 5: Value Analysis**
Principles of value analysis, Benefits & applications of value analysis, Methods for improving the effectiveness of value analysis, Decision /evaluation Matrix: Quantitative comparison of alternatives, estimation of weight factors and efficiency  
(06 Lectures)

**Module 6: Life cycle costing**
Forecasting of Capital as well as operating & maintenance costs, time value, present worth analysis, DCF methods, ROR analysis, sensitivity analysis, Different methods of performing value engineering  
(06 Lectures)
Guidelines for Assignments: Minimum six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of any Three Modules.

References:
- Value Engineering: Analysis and Methodology By Del Younke
- Estimating and Costing in Civil Engineering: Theory and Practice B.N Dutta Published
- Dutta & Company, Lucknow.
- Estimating, Costing Specifications & valuation in Civil Engineering By: M.Chakraborty Published By: Author.
- Estimating and Costing By: G.S.Birdie
- Estimating and Costing By: Rangwala Published By: Charotar Publishing House,
- Practical Information for Quantity Surveyors, Property valuers, Architects Engineers and Builders, P.T.Joglekar, Pune VidyarthiGrihaPrakashan, 2008 reprint.

Outcomes:
Upon completion of the course the students will be able to:
- Understand concepts in structural health monitoring and acquire knowledge of smart materials.
- Understand vibration control methods in structural health monitoring.
- Understand electrical impedance methods in structural health monitoring.
- Understand wave propagation methods in structural health monitoring.
- Understand advanced signal processing techniques in structural health monitoring.
- Understand applications of structural health monitoring in different structural systems.

Elective IV

CVIEM-E4/01 Resource Management

Teaching Schemes: 3 Lect. hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Materials Management
Importance of materials management and its role in construction industry-scope, objectives and functions, integrated approach to materials management, Role of materials manager, Classification and Codification of materials of construction. (07 Lectures)

Module 2: ABC analysis
Procedure and its use, Standardization in materials and their management, Procurement, identification of sources of procurement, vendor analysis, Vendor analysis concept of (MRKP), Material requirement planning, planning, purchase procedure, legal aspects. (07 Lectures)

Module 3: Inventory Management
Inventory Control techniques. EOQ, Advantages and limitation of use of EOQ, Periodic ordering, order point control, safety stock, stock outs, application of AC analysis in inventory control, concept of (JIT)- Just in time management, Indices used for assessment of effectiveness of inventory management.

Module 4: Stores Management
Receipt and inspection, care and safety in handling, loss on storage, wastage, Bulk purchasing, site layout and site organization, scheduling of men, materials and equipment.

Module 5: Use of MMS
Materials Management Systems in materials planning, procurement, inventory, control, cost control etc.

Module 6: Need for Development of Human Resource
Flow diagram of human resource development and human resource management, Training, competency development, capacity building of resources required at grass root level and at the managerial level in construction.

Guidelines for Assignments: Minimum six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of any Three Modules.

References
- K. S. Menon, “Purchasing and Inventory Control”, Wheeler Publication
- Dr. Mahesh Verma, “Construction equipment planning and applications”
- Bohlander & Snell, “Managing Human Resources”.

Elective IV
CVIEM-E4/02 Urban Hydrology and Storm Water Management

Teaching Schemes: 3 Lect. hrs/week; Evaluation Scheme: Theory: 60; Mid-semester Exam 20; Class Assessment 20

Course Contents

Module 1: Urban hydrologic process:

Module 2: Storm water modelling
Analysis of hydrologic changes due to urbanization, Approaches to study, Data collection and analysis, Probabilistic and statistical approaches, Modelling of urban water quantity, Types of models, Rainfall, Runoff modelling, urban watershed modelling (quantity), Rational Method (or coefficient method), Runoff hydrograph, unit hydrographs, synthetic unit hydrograph, Urban watershed modelling for water quality of runoff and stream water quality.

Module 3: Storm water management
Urban storm runoff quantity and quality management, Mitigation of damaging effects of urban storm runoff Structural and non-structural, control measures, Storm water management models.
Module 4: Urban drainage systems
Sanitary and combined sewer systems, components, Design considerations for fixing sewer capacity, Infiltration into and exfiltration from sewers, causes, Infiltration inflow analysis, Field investigations, Control measures. (7 Lectures)

Module 5: Design consideration of the components of the sewer systems
Performance of the sewer system both under dry weather flow condition and under storm water impact, Sewer sediment (07 Lectures)

Module 6: Urban drainage systems maintenance
Maintenance management of UDS and its subsystems, Drainage system, Storm drain conveyance system, Pump stations, Open channel, illicit connections and discharges, Spill response, Other considerations (limitations and regulations). (07 Lectures)

Guidelines for Assignments: Minimum six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of any Three Modules.

References
- Stormwater Hydrology and Drainage “ by D.Stephenson, Elsevier Publications.
- “Urban Water Infrastructure Planning, Management, and Operations” by Neil S.Grigg, John Wiley & Sons
- “Manual of Sewerage and Sewage Treatment” Ministry of works and Housing, Government of India.
- Understand Various Retrofitting methods for RC framed structure and masonry structures.

Outcomes:
Upon completion of the course the students will be able to:

Elective V
CVIEM-E5/01 Safety Management in Construction (Open Elective)

Teaching Schemes: 4 Pract. hrs/week; Evaluation Scheme: Class Assessment 25; Oral Examination 25.

Course Contents

Module 1: Construction Safety Management
Role of various parties, duties and responsibilities of top management, site managers, supervisor's etc., role of safety officers, responsibilities of general employees, safety committee (7 Lectures)

Module 2: Safety Benefits
Safety training, incentives and monitoring, writing safety manuals, preparing safety checklists and inspection reports (7 Lectures)
Module 3: Safety in construction operations
Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Approach to improve safety in construction for different work, Measuring safety, Prevention of accidents, Safety measures. (7 Lectures)

Module 4: Safety in use of construction equipment
Vehicles, cranes, hoist and lift etc. Safety of scaffolding and working platforms, Safety while using electrical appliances, Explosives, Prevention of fires at construction site. (7 Lectures)

Module 5: Various safety equipment and gear used on site
First aid on site, Labour laws, legal requirement and cost aspects of accidents on site, Safety Audit. (7 Lectures)

Module 6: Study of safety policies
Methods, equipment, training provided on any ISO approved construction company. (7 Lectures)

References:
- Construction Safety Manual - Published by National Safety Commission of India.
- Safety Management in Construction Industry – A manual for project managers. NICMAR Mumbai
- ISI for safety in Construction – Bureau of Indian Standards.
- Safety management – Grimaldi and Simonds (AITBS, New Delhi)

Elective V

CVIEM-E5/02 Research Methodology (Open Elective)

Teaching Schemes: 4 Pract. hrs/week; Evaluation Scheme: Class Assessment 25; Oral Examination 25

Module 1:
Introduction, meaning of research, objectives, types and role of scientific and engineering related research in advancing the knowledge, defining a research problem, formulation of a hypothesis, research design and features of good design, methods of data collection, approaches and techniques for data acquisition, processing, analyses and synthesis, Designing a questionnaire, Interpretation of results, Report Writing, Aspects of literature review, Different ways of communication and dissemination of research results. (06 Lectures)

Module 02:
Descriptive Statistics, Probability and Distribution: Basic statistical concepts, Measures of central tendency and dispersion, Elements of Probability, Addition and multiplication theorems of probability, Examples, probability distributions, Binomial, Poisson and normal distributions. (06 Lectures)

Module 03:
Sampling Techniques: Random sampling, simple random sampling and stratified random sampling, Non-sampling errors. (06 Lectures)

Module 04:
Correlation and Regression: Product moment correlation coefficient and its properties. Simple linear regression and multiple linear regressions. Statistical Inference: Statistical hypotheses, Error Types, level of significance, Chi-square Test and F distributions. Central limit theorem, Tests for the mean, equality of two means, variance, large sample tests for proportions, Confidence interval. (06 Lectures)

Module 05:
Design of Experiments: Analysis of variance. Data Classification, Completely randomized, randomized block, Factorial experiments, Yates technique. (06 Lectures)

Module 06:
Multivariate Data Analysis: Multivariate normal distributions. Mean vector, variance, covariance matrix and correlation matrix, Step wise regression, Selection of best subject of variables, Classification and discrimination problems, Factor analysis, Principal component analysis, Data analysis using software's. (06 Lectures)

Term Work
Student shall critically read recent three to four journal articles within the broader field of their prospective specializations to identify research and knowledge gaps and accordingly formulate specific research questions. On the basis of these research questions student will retrieve additional relevant information and prepare well-articulated and content rich introductory problem description as well as proposed research methodology notes. This shall be assessed jointly by the subject teacher and research guide of the student.

References
- Ross S. M., “Introduction to Probability and Statistics for Engineers and Scientists”, 3rd Edi, Elsevier
- Miller and Freund: Probability and Statistics for Engineers”, EEE

Outcomes:
Upon completion of the course the students will be able to:
- Understand concept of research, its types, methods, detailed procedure to identify and solve a research problem.
- Understand various mathematical techniques useful in research work.
- Understand various sampling techniques useful in research work.
- Understand various techniques for correlating and predicting different parameters with each other based on data collected.
- Design the experiments for research work.
- Analyze and interpret the data, results and to conclude the final results.
**CVIEM-S01 Seminar I**

**Laboratory Scheme:**
Seminar I shall be delivered on one of the advanced topics chosen in consultation with the supervisor after compiling the information from the latest literature. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. Minimum 03 presentations are expected within period of semester by the student. A hard copy of the report (20 to 25 pages, A4 size, 12 fonts, Times New Roman, 1.5 line spacing with normal margin on all sides, both side printed, as per format) should be submitted to the Department Post Graduate Committee (DPGC) before delivering the seminar. A copy of the report in soft form must be submitted to the Supervisor along with other details, if any.

**CVSE-L02 PG Lab 2**

1. Term work should consist of total 10 assignments or Project report
2. It shall consist of 2 assignments/assigned work based on each of the 5 subjects of First year Term –II.
3. Assignments may consists of theory questions, work study, site reports or software based work
4. Journal shall consist of these assignments.
5. Oral shall be taken based on term work.

**CVIEM-L02 Mini Project**

**Laboratory Scheme:**
Mini project shall be based on one of the topic chosen in consultation with the supervisor. Mini project may be interdisciplinary nature. Areas of recent techno-management development shall be explored. Research innovations may be considered as prospective areas. Mini project may be related with main project to explore possibilities of continuation further and to study the pre-requisites.

**Semester- III**

**Project Management and Intellectual Property Rights**

**Teaching Schemes:** Self Study; **Evaluation Scheme:** Class Assessment 25; Oral Examination 25

**Course Content**

Project Management

**Module 1: Introduction to Project Management**
Brief history of project management, Role of a Project Manager, benefits of project management, Project vs. operation, Project lifecycle: Initiating, Planning, Executing, Controlling, and Closing processes. Project Integration Management - Project plan development, Project plan execution, and Overall change control.

Module 2: Beginning a Project
Project Selection, Defining criteria, Project selection methods, Sacred Cow, Comparative Benefit Model (CBM), Quality functional deployment (QFD), Scope Definition, Project Charter development

Module 3: Risk Management
Project Risk Management Processes, Types of Risk, Risk Defined, Risk Factors, Risk Factors Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk planning, Risk control.

Module 4: Professional Responsibility (Ethics)
Ensuring Integrity and Professionalism, Project Management Knowledge Base, Enhancing Individual Competence, Balancing Stakeholder Interests, Interactions with Team Members and Stakeholders, Templates, Tools and Techniques.

Intellectual Property Rights

Module 5: Introduction to Intellectual Property Rights

International Scenario
International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT

Module 6: Patent Rights
Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications

Recent Developments in IPR
Administration of Patent System, New developments in IPR, IPR of Biological Systems, Computer Software etc., Traditional knowledge Case Studies

References

CVCTMPS1 Project Stage I

Evaluation Scheme: Class Assessment 25; Oral Examination 25

Dissertation Stage I and Synopsis Approval Presentation:
It is a course requirement under the guidance of faculty Supervisor. PG student from second year is required to do innovative and research oriented applied work related to various theory and laboratory courses. Dissertation work may cover analytical formulation, experimentation or survey based project or combination of these. Students are encouraged to undertake an interdisciplinary type project.

- **Synopsis:**
  It is expected from the student to carry out exhaustive literature survey with consultation of his/her Supervisor for not less than 15 reputed national, international journal and conference papers. Student should present the Synopsis Submission Presentation (SSP) with literature survey report to justify about the research gap, innovativeness, applicability, relevance and significance of the work. Student shall undertake project work after approval of synopsis.

- **Dissertation Stage I presentation:**
  It is expected that student shall present preliminary results from his/her work during the semester with report as per prescribed format. If student is not showing satisfactory performance, then he/she will be given grace period of 2 weeks. After 2 weeks student will be again evaluated with grade penalty. Minimum 02 ISE presentations should be delivered by the student during semester.

**Semester- IV**

**CVCTMPS2 Project Stage II**

**Evaluation Scheme:** Class Assessment 25; Oral Examination 25

Based on the guidelines and progress of stage II works, all the desired work should be completed and final dissertation report will be prepared and presented during examination. It is desirable that student presents/publishes the research paper in peer reviewed conference/research journals. If student is not showing satisfactory performance, then he/she will be given grace period of 4 weeks. After 4 weeks student will be again evaluated with grade penalty.