

**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

Sr. No.	Subject Code	Name of Subject	Hours /Week			Credit	Examination Scheme				
			L	P	T		Theory		CA	PR/OR	Total
							TH	MTE			
01	CVIEM101	Infrastructure Planning	03	--	1	04	60	20	20	--	100
02	CVIEM102	Life Cycle Cost Analysis of Infrastructure	03	--	1	04	60	20	20	--	100
03	CVIEM103	Construction Management Practices	03	--	1	04	60	20	20	--	100
04	CVIEM104	Communication Skills	02	--	--	02	--	--	25	25	50
05	CVIEM-L01	PG Lab-I	--	03	--	02	--	--	25	25	50
06	CVIEM-E1	Elective-I	03	--	--	03	60	20	20	--	100
07	CVIEM-E2	Elective-II	03	--	--	03	60	20	20	--	100
Total for Semester I			17	03	03	22	300	100	150	50	600

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

Sr. No.	Subject Code	Name of Subject	Hours /Week			Credit	Examination Scheme				
			L	P	T		Theory		CA	PR/OR	Total
							TH	MTE			
01	CVIEM201	Construction Equipment Management	03	--	1	04	60	20	20	--	100
02	CVIEM202	Infrastructure Development	03	--	1	04	60	20	20	--	100
03	CVIEM-S01	Seminar-I	--	04	--	02	--	--	50	50	100
04	CVIEM-L02	PG Lab-II or Mini -Project	--	04	--	02	--	--	50	50	100
05	CVIEM-E3	Elective-III (Departmental)	03	--	--	03	60	20	20	--	100
06	CVIEM-E4	Elective-IV (Departmental)	03	--	--	03	60	20	20	--	100
07	CVIEM-E5	Elective-V (Open)	03	--	--	03	60	20	20	--	100
Total for Semester II			15	08	02	21	300	100	200	100	700

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

Sr. No.	Subject Code	Name of the subject	Hours/Week			Credit	Examination scheme				
			L	P	T		Theory		CA	PR / OR	Total
							TH	Test			
1	CVIEM301	Project Management and Intellectual Property Rights (Self Study)*	--	--	--	02	--	--	50	50	100
2	CVIEMPS1	Project Stage -I	--	--	--	10	--	--	50	50	100
Total for Semester III			--	--	--	12	--	--	100	100	200

Fourth Semester

Sr. No.	Subject Code	Name of the subject	Hours/Week			Credit	Examination scheme				
			L	P	T		Theory		CA	PR / OR	Total
							TH	Test			
1	CVIEMPS2	Project Stage-II	-	-	-	20	-	-	100	100	200
	Total for Semester IV		-	-	-	20	-	-	100	100	200
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:

- S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
- J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
- P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
- J. D. Finnerty, Project financing - Asset-based financial engineering, John Wiley & Sons, New York, 1996.

- S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
- J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
- L. Squire and H. G. van der Tak, Economic analysis of projects, John Hopkins University Press, London, 1975.
- T. J. Webster, Managerial economics: Theory and practices, Elsevier, New Delhi, 2003.

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

Relevant Effects, Cost Categories, Timing of Cash Flow, Using Base Rate Prices to Estimate Future Cost, Estimating Investment Related Cost, Estimating Operational Costs, Initial Investment Costs, Operations Costs, Maintenance & Repair Costs, Replacement Costs **(07 Lectures)**

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

- Dale S J, Introduction to life cycle costing, in Bull J W (ed) Life cycle costing for construction, Blackie Academic & Professional, Glasgow
- Fabrycky W J and Blanchard B S, Life-cycle cost and economic analysis, Printice-Hall Inc, NJ
- Flanagan R, Norman G and Furbur D, Life cycle costing for construction, Surveyors Publications
- Flanagan R, Norman G, Meadows J and Robinson G, Life cycle costing - theory and practice, BSP Professional Books (1989)
- Kirk S J and Dell'Isola A J, Life cycle costing for design professionals, McGraw-Hill Book Company, New York

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 **(07 Lectures)**

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 **(07 Lectures)**

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 **(07 Lectures)**

Module 4: Project Controlling

Monitoring and Control of construction project, Network Crashing, Resource constrained scheduling, Resource Leveling and Smoothing, Project Updating, Non-linear cost time trade off, Project updating – methods of updating, Site layout and mobilization **(07 Lectures)**

Module 5: Cost optimization

Project cost formulation, Optimization of cost through network contraction, linear programming and Project life cycle cost **(07 Lectures)**

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 **(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:

- Moder J.J. Philips, C.R. and Davis, E.W. “Project Management with CPM and PERT, and Precedence Diagramming”, C.B.S. publishers and distributors, New Delhi, 1986.
- Pilcher, R. “Project Cost Control in Construction”, Collins, London, 1992.
- O’Brien J.J. CPM in “Construction Management”, Mc. Graw Hill Book Company, Inc. NY, 1971.
- S. Seetharaman, “Construction Engineering and Management”, (4th Edition) Umesh Publications, New Delhi.
- P S Gahlot & B M Dhir, “Construction Planning & management “, New Age International Limited Publishers
- Kumar Neeraj Jha, “Construction Project Management Theory & practice,” Pearson Publication
- Harris, “Modern construction management,” Wiley India.
- Sengupta and Guha, “Construction Management and Planning”, Tata McGraw Hill publication.
- K Nagrajan , Project Management , New age International Limited.
- Ahuja H.N. , “Professional Construction Management Barrie”, Paulson-McGraw Hill Institute Edition.
- John Wiely, “Project Management”, New York.
- Chitakara, “Construction Project Management Planning, Scheduling and Controlling”, Tata McGraw Hill, New Delhi
- Rory Burkey 4th ed., “Project Management-Planning and Control”, Wiley Publication
- Sengupta and Guha, Construction Management and Planning, Tata McGraw Hill Publication.
- Barrie & Paulson, Professional Construction Management, McGraw Hill Institute Edition.
- Roy, Pilcher Construction Management

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 **(07 Lectures)**

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 **(07 Lectures)**

Module 6: Other services and approvals

Gas services & distribution piping, Roof water harvesting & water conservation, Approval of authorities for water supply **(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

- National Building code, Bureau of Indian standard
- Acoustical designing in Architecture, by V .O.Kusen & C.M.Harris, John.Wiley&Son .
- Acoustic designing & practice, by R.L.Suri, Asia Publishing House.
- Architecture acoustics, by Anita Lawrence.
- Main climae & architecture B.Govoni, Elsvire Publishing co.
- Thermal Performance of Building by J.P Van Stratten, Elsvier 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. **(07 Lectures)**

Module 2: Design Issues

Sea port layout with regards to (1) wave action (2) siltation (3) navigability berthing facilities **(07 Lectures)**

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 **(07 Lectures)**

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.). **(07 Lectures)**

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 **(07 Lectures)**

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 **(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:

- Muir Wood, A.M., and Fleming. C.A., "Coastal Hydraulics Sea and Inland Port Structures", Hallstead press.
- Ozha & Ozha, "Dock and Harbour Engineering", Charoter Books, Anand.
- Seetharaman, S., "Dock and Harbour Engineering", Umesh Publications.
- Richard L. Silister, "Coastal Engineering Volume I & II, Elsevier Publishers.
- Pera Bruun, "Port Engineering", Gulf Publishing Company

Outcomes:

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

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

Role 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. **(07 Lectures)**

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 route locations, drainage studies, soil and pavement design investigations **(07 Lectures)**

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 **(07 Lectures)**

Module 4: Pavement design

Pavement types, components, functions, design factors, Design of flexible pavements, CBR Method, IRC: 37-2001. Design of rigid pavement: Westergaard's analysis of wheel load stress, temperature stresses. Highway Construction: Highway materials, WMM roads, bituminous roads-BC, SDBC, DBM; concrete roads-DLC, PQC; soil stabilized road, MOST specifications. Deficiency in flexible and rigid pavement, methods of pavement evaluation, strengthening of existing pavements, highway maintenance, related IRC specifications **(07 Lectures)**

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 **(07 Lectures)**

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 **(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:

- Khanna S.K. and C.E.G. Justo (2000): Highway Engineering, Nem Chand & Bros., Roorkee.
- Partha Chakroborty and Animesh Das (2003): Principles of Transportation Engineering, Prentice-Hall India, New Delhi.
- Drew D.R. (1968): Traffic Flow Theory and Control, McGraw-Hill, New York.
- Hutchinson B.G. (1974): Principles of Urban Transport Systems Planning. McGraw-Hill Book Co., New York.
- Yang H. Huang (1993): Pavement Analysis and Design, PrenticeHall.
- L. R. Kadiyali "Traffic Engineering and transport planning", Khanna Publishers.
- 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:

Elective II

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:

Preparation of tender documents, Issues related to tendering process –Awarding contract, Incentives and penalties in specifications, Sale of Goods Act. Professional ethics, Global tenders and B.O.T. System (08 Lectures)

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,
- “Engineering Contracts and Arbitration”, by B.J. Vasavada (March 1996).
- “Laws relating to Building and Engineer’s Contracts” by G.T. Gajaria – M.M. Tripathi Pvt. Ltd., Mumbai, 1985.
- “Professional Practice” by Roshan Namavat”, published by Anupbhai Publications.
- K. Collex, “Managing Construction Contracts”, Reston publishing Co, Virginia, 1982.
- W.B. Park “Construction Bidding for Projects”, John Wiley, Ny, 1978.
- "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

CVIEM-E2/03 Operation Research

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

Introduction, Structure of the Mathematical Model, Limitations of Operations Research, Identification of civil engineering systems and their methods of analysis (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

Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of 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
- S.S. Rao, "Engineering Optimization Theory & Practice", Wiley.
- Ravindran, "Engineering Optimization, Methods and Applications", Wiley.
- J.K.Sharma, "Operations Research," Macmillan India Ltd. 2006.
- N.D.Vohra, "Quantitative Techniques in Management," Mcgraw hill Publication
- R.Pilcher, "Principles of Construction Management"
- E.S.Buffa, "Operations Management" Wiley, India
- H.M.Wagner, "Principles of Operation Research" Prentice Hall Publication.
- Hira and Gupta, "Operation Research" S.Chand Publication
- Ravindrav, Philip & Solberg, "Operations Research: Principles and Practice," Wiley, India

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

Research Proposal: Essentials, Abstract, Aims, Background & significance, Design & methods, Writing a sample proposal.
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:

- S. Hariharan, et.al. Soft Skills; MJP Publishers, 2010.
- John Seely, Oxford Guide to Effective Writing and Speaking; Oxford University Press, 2009.
- Thomas N. Huckin and Leslie A. Olsen, Technical Writing and Professional Communication for Nonnative Speakers of English; Tata McGraw Hills, International Edition, 1991.
- Jeff Butterfield, Soft Skills for Everyone, Cengage Learning India Private Limited, 2010.
- 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.

Superstructure: Concrete and reinforced concrete works – forms work –reinforcement –concreting – mechanized methods of erection of Buildings and installations, Cast-in-situ and pre-cast concrete. Concreting below G.L. – wall in situ method for cast in situ and precast concrete – under water concreting design of forms **(08 Lectures)**

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

- Mahesh Varma (1997) “Construction Equipment and its Planning and Applications” Metropolitan Book Co.(P) Ltd., New Delhi. India.
- B. Sengupta and H. Guha : “Construction Management and Planning “ (TMH Publication)
- S. Seetharaman, “Construction Engineering and Management” Umesh Publications, Delhi.
- Rangwala “Construction of Structures and Management of Works” (Charotar publishers)
- U.K. Srivatsava (1999) “Construction Planning and Management “Galgotia Publications Pvt. Ltd., New Delhi,India.
- Peurify, R.L. (1996) “Construction Planning, Equipment and Methods”.
- Jay P.K. “Handbook of Construction Management” – Macmillan India Ltd., New Delhi, 1990.

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

- CE & CR Magazine.
- Construction World Magazine.

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

Rules, Regulations & Laws governing Energy Conservation in India & Developed Nations - Energy Conservation Act 2001, Revisions and Present State of Implementation Standardization & Labelling, Electricity Act 2003, Revisions and Present Status of Implementation. United Nations Framework Convention on Climate Change (UNFCCC), Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon Funds(PCF), Carbon Credits and it's trading, Benefits to developing countries (06 Lectures)

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

Energy Efficiency Projects, Evaluation of Energy Efficient Projects, Various ways of Financing Energy Efficiency Projects, Role of Financial Institutions and Corporate Banks, Deferred Payment Financing, Types of Energy Performance Contracts, Energy Service Companies (ESCOs) and their Role, Emphasis on ESCOs (07 Lectures)

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:

- Management of Energy Environment Systems -W.K.Hall, John Wiley and Sons.
- Energy Management and Control Systems -M.C.Macedo Jr., John Wiley and Sons.
- Environmental Impact Analysis Handbook -J.G.Rau, D.C.Wood, McGraw Hill.

- Energy & Environment – J.M. Fowler, McGrawHill.
- Energy Management W R Murphy; G Mckay, B.S. Publications
- Renewable Energy and Energy Management S C Patra; B C Kurse; R Kataki Int. Book Co.
- Operations and Maintenance Manual for Energy Management, J Piper, Standard Publishers.
- Environmental Pollution Compliance H.C. Sharma CBS Publishers.

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
- Industrial Engg. & Mgt., O.P.Khanna, DhanpatRai Publ.
- Industrial Organization & Engg. Economics, T.R.Banga, S.C.Sharma, Khanna Publ.
- 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. **(07 Lectures)**

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. **(07 Lectures)**

Module 5: Use of MMS

Materials Management Systems in materials planning, procurement, inventory, control, cost control etc. **(07 Lectures)**

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. **(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

- K. S. Menon, “Purchasing and Inventory Control”, Wheeler Publication
- Dr. Mahesh Verma, “Construction equipment planning and applications”
- Robert Peurifoy, “Construction planning, equipment and methods”, Tata McGraw Hill.
- Biswajeet Pattanayak, “Introduction to Human Resource Management”.
- 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:

Process of urbanization, Water in Urban ecosystem, Urban water subsystems, Urban hydrologic cycle, Impact of urbanization on urban runoff and stream flow quantity, Impact of urbanization on quality of runoff and stream flow, Erosion due to urban runoff.

(07 Lectures)

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.

(07 Lectures)

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.

(07 Lectures)

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 Hydrology” by J.M.Hall, Elsevier Applied Science Publishing Company.
- “Storm water Modeling” by Overtens D.E., and Meadows M.E., Academic Press, NY.
- “Urban Water Infrastructure Planning, Management, and Operations” by Neil S.Grigg, John Wiley & Sons
- “Introduction to Hydrology” by Viessman W.I., Knapp J.W., Lewis G.L., and Henbrough, T.E., Harper and Row Publishing Company.
- “Manual of Sewerage and Sewage Treatment” Ministry of works and Housing, Government of India.
- “Applied Hydrology”, by K.N. Mutreja, Tata McGraw- Hill publishing company Ltd., New Delhi.
- “Engineering Hydrology”, by K. Subramanya, Tata McGraw- Hill publishing company Ltd., New Delhi.
- 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
- Construction Safety Handbook – Davies V.S.Thomasin K, Thomas (Telford, London.)
- 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

- Gupta S. C. and Kapoor V. K, "Fundamentals of Mathematical Statistics", Sultan Chand & Company New Delhi.
- Gupta S. C. and Kapoor V. K, "Fundamentals of Applied Statistics", Sultan Chand & Com. N.Delhi.
- Montgomery D. C., "Probability and Applied Statistics for Engineers", Wiley Int.Student Edition
- Walpole Ronald E, Myers Raymond H and Myers Sharon L, "Probability & Statistics for Engineers and Scientists", 6thEdition, Prentice Hall.
- Ross S. M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edi, Elsevier
- Miller and Freund: Probability and Statistics for Engineers", EEE
- Johnson R. and Wichern, "Applied Multivariate Statistical Analysis", 3rd Edi, Prentice Hall India
- Douben K. J., "Research Methodologies – Principles and Guidelines of Applied Scientific Research", UNESCO-IHE Lecture Notes LN0317/06/01, Delft, the Netherlands.
- Holtom D. and E. Fisher, "Enjoy Writing Your Science Thesis - a Step by Step Guide to Planning and Writing Dissertations and Theses for Undergraduate and Graduate Science Students", Imperial College Press. ISBN 1-86094-207-5, London, UK.
- Kumar R., "Research Methodology- a Step-by-step Guide for Beginners", Sage Publi.. ISBN 0-7619-6213-1. London, UK.

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.
- Analyse 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. **(06 Lectures)**

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 **(06 Lectures)**

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. **(06 Lectures)**

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. **(06 Lectures)**

Intellectual Property Rights

Module 5: Introduction to Intellectual Property Rights

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

International Scenario

International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT **(06 Lectures)**

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 **(06 Lectures)**

References

- PMBOK® Guide 5th Edition, ISBN 978-1935589679
- Managing Across Cultures: The 7 Keys to Doing Business with a Global Mindset 1st Edition, ISBN 978-0071605854
- The PMP Exam: How to Pass on Your First Try 5th Edition, ISBN 978-0982760857
- The PMP Exam: Quick Reference Guide 5th Edition, ISBN 978-0982760895
- T. Hegazy, Computer-based construction project management, Prentice Hall, New Jersey, 2002.
- S. M. Levy, Project management in construction, 5 th ed., McGraw Hill, New York, 2007.
- PMI, A guide to the project management body of knowledge, 3 rd ed., Project Management Institute, Pennsylvania, 1996.
- Prabuddha Ganguly, “Intellectual Property Rights”, Tata Mc-Graw Hill.
- Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley “Intellectual Property in New Technological Age”.

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.