NORTH MAHARASHTRA UNIVERSITY, JALGOAN

M.E.(CIVIL)

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

SYLLABUS

MASTER OF ENGINEERING (M.E.)
(Infrastructure Engineering and Management)

2011-2012

North Maharashtra University, Jalgaon
M.E. (Infrastructure Engineering and Management)
Examination scheme and structure with effect from the year 2011-12

FIRST YEAR : TERM –I

Reno.	Subject Name	Teaching Scheme	Examination Scheme

		Hours/Week		Paper Duration	Maximum Marks			
		Lectures	Practical	In Hours	Paper	TW	PR	OR
1	Construction Planning, Scheduling and Management	03	-	03	100	-	-	-
2	Contracts, Administration and Arbitration	03	-	03	100	-	-	-
3	Life Cycle Costing of Infrastructures	03	-	03	100	-	-	-
4	Irrigation Water Distribution Systems	03	-	03	100	-	-	-
5	Elective_I i) Highway Projects Planning, Designing And Economic Evaluation ii) Retrofitting and	03	-	03	100	-	-	

	Rehabilitation of Structures iii) Ports and harbor structures.							
6	Laboratory Practice-I	-	06	-	-	100	-	50
7	Seminar –I	-	04	-	-	100	-	-
	Total	15	10	-	500	200		50
	Grand Total			25			750	

Laboratory Practice-I – Two assignments on each of five subjects given above. Journal shall consist of total 10 assignments**.**

North Maharashtra University, Jalgaon
M.E. (Infrastructure Engineering and Management)
Examination scheme and structure with effect from the year 2011-12
FIRST YEAR : TERM –II

Reno.	Subject Name	Teaching Scheme	Examination Scheme					
		Hours/Week		Paper Duration	Maximum Marks			
		Lectures	Practical	In Hours	Paper	TW	PR	OR
1	Construction Methods and Equipment Management	03	-	03	100	-	-	-
2	Safety Management In Construction	03	-	03	100	-	-	-

3	Advanced Concrete Technology	03	-	03	100	-	-	-
4	Environment & Energy Management.	03	-	03	100	-	-	-
5	Elective –II i) Geotechniques for Infrastructure. ii) Resource Management iii) Urban Hydrology and Storm Water Management.	03	-	03	100	-	-	
6	Laboratory Practice-II	-	06	-	-	100	-	50
7	Seminar –II	-	04	-	-	100	-	-
	Total	15	10	-	500	200		50
	Grand Total			25			750	

Laboratory Practice-II – Two assignment on each of five subjects given above. Journal shall consist of total 10 assignments**.**

North Maharashtra University, Jalgaon
M.E. (Infrastructure Engineering and Management)
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SECOND YEAR : TERM –I

Sr.No.	Subject Name	Teaching Scheme		Examination Scheme				
				Hours/Week	Paper Duration	Maximum Marks		
		Lectures	Practical	In Hours	Paper	TW	PR	OR
1	Seminar-III	--	4	--	--	50	--	50
2	Project Stage I	--	18	--	--	100	--	--
Total	--	22	--	--	150	--	50	
Grand Total		22				200		

SECOND YEAR : TERM –II

Sr.No.	Subject Name	Teaching Scheme		Examination Scheme				
				Hours/Week	Paper Duration	Maximum Marks		
		Lectures	Practical	In Hours	Paper	TW	PR	OR
1	Progress Seminar	--	--	--	--	50	--	--
2	Project Stage-II	--	18	--	--	150	--	100

Total	--	18	--	--	200	--	100
Grand Total		18					300

Semester – I

I. CONSTRUCTION PLANNING, SCHEDULING AND MANAGEMENT

Max Marks : 100 **Duration : 3.00 Hours**

Lectures : 3.00 Hrs/Week

Introduction to project planning, scheduling –methods of scheduling – controlling. Job layout work break down structure –LOB technique.

Network techniques in construction management –creating network schedule – rules –advantages of net works.

PERT and CPM net works – application to construction problems.

Precedence networks – advantages – Logic or precedence networks – applications.

Cost control in construction – importance of cost control and its objectives

Optimization of cost through network contraction – Linear programming methods for cost optimization : Critical path using L.P. project cost formulation – non-linear cost time trade off.

Resources analysis, smoothing and scheduling.

Project updating – methods of updating.

References Books:

1. 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.
2. Pilcher, R. “Project Cost Control in Construction”, Collins, London, 1992.
3. O’Brien J.J. CPM in “Construction Management”, Mc. Graw Hill Book Company, Inc. NY, 1971.
4. S.Seetharaman, “Construction Engineering and Management”, (4th Edition) Umesh publications, New Delhi.

Semester – I

II. CONTRACTS, ADMINISTRATION AND ARBITRATION

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

Contracts Administration – The standard forms of building contracts, the rights of building owners, adjoining owners and third parties. The Indian Contract Act, 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

Time Of Performance - provisions of contract law – Breach of contract. Contracts for projects under International AID

Industrial Act And Labour Laws – Industrial Dispute Acts, payment of wages act, Minimum Wages Act, Indian Trade Union Act, and Workmen's Compensation Act.

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.

Administration of Incentive schemes- Necessity, merit rating, Job evaluation installation, modification and maintaining, incentive scheme based on implementation experience.

Reference Books:

1. "Codes of Practice and Standard Specifications" of AP PWD,. CP WD, MES etc, Anupbhai Publications,.,
2. "Engineering Contracts and Arbitration", by B.J. Vasavada (March 1996).
3. "Laws relating to Building and Engineer's Contracts" by G.T. Gajaria – M.M. Tripathi Pvt. Ltd., Mumbai, 1985.
4. "Professional Practice" by Roshan Namavat", published by Anupbhai Publications.
5. M.O'c Horgon and F.R. Roulstion " Project Control of Engineering contracts E and FN, SPON, Ny, 1988.

6. K. Collex, “Managing Construction Contracts”, Reston publishing Company, Virginia, 1982.
7. W.B. Park “Construction Bidding for Projects”, John Wiley, Ny, 1978.
8. "Latest Amendments to latest versions of Building Bye-Laws and Engineering Contract Laws”.
9. “Estimating and Costing” by B. S. Patil (Vol 1 & 2).
10. “Estimating and costing” by M Chakraborty.
11. “Estimating and costing” by B.N Dutta.
12.Construction contracts and claims – Simon M.S. (McGraw Hill, New York)
13. Construction Contract Management-NICMAR publication
14. Handbook of estimating & costing for Quantity Surveyors - P. T. Joglekar

Semester – I

III. LIFE CYCLE COSTING OF INFRASTRUCTURES

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

Life Cycle costing : An Introduction
Background, Definition of Life Cycle costing, Uses of Life Cycle costing, Implementation of LCC, Economic Indicators, Aim and Objectives

Data requirements of Life Cycle costing
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

Estimating Costs for LCC Analysis
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

Calculating LCC & 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.

Implementation of Life Cycle costing
Introduction, Stages of implementation, Logic of implementation, The cost break down structure, WLC software

Mathematical modeling of Life Cycle costs
Introduction, LCC decision rules, Mathematical LCC models,

Uncertainty and risk assessment in Life Cycle costing

Introduction, The sensitivity analysis, Deterministic & Probability-based techniques, The fuzzy approach, The integrated approach

Reference Books -

1. Ashworth A, Cost studies of buildings, Longman
2. Byrne P, Risk, uncertainty and decision-making in property development, E & F N Spon, London
3. Dale S J, Introduction to life cycle costing, in Bull J W (*ed*) Life cycle costing for construction, Blackie Academic & Professional, Glasgow
4. Fabrycky W J and Blanchard B S, Life-cycle cost and economic analysis, Printice-Hall Inc, NJ
5. Flanagan R, Norman G and Furbur D, Life cycle costing for construction, Surveyors Publications
6. Flanagan R, Norman G, Meadows J and Robinson G, Life cycle costing - theory and practice, BSP Professional Books (1989)
7. Kirk S J and Dell'Isola A J, Life cycle costing for design professionals, McGrew-Hill Book Company, New York

Semester – I

IV. IRRIGATION WATER DISTRIBUTION SYSTEMS

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

Introduction, Irrigation development in India – types of irrigation systems – methods of distribution , Distribution works, Types of Head works – Classification of Channels – Regulations, Drops, Canal escapes – Sluices – Syphons, canal : Design of erodible – non-erodible channels – division box – diversion box – outlet , block design – commandability – realignment of block – operation and maintenance.

closed conduit distribution : Drip – Sprinkler – Underground pipe design – Layout – Evaluation – Operation and Maintenance. flow measurements : Flow measuring structures – Flumes, Weirs – Orifices
Dilution Techniques –Channel transitions – Canal losses – Measurement of losses.

Reference Books :

1. R.S. Varshney, S.C.Gupta and R.L. Gupta, “Theory and Design of Irrigation Structures”, Nemchand & Brothers, Roorkee.
2. A.M. Michael, “Irrigation Theory and Practice”, Vikas Publishing House Pvt. Ltd.
3. R.K. Sharma, “Irrigation Engineering and Hydraulic Structures”, Oxford and IBH Publishing Co., New Delhi.
4. Richard H. Cuneca, “Irrgation Systems Design (An Engineering Approach) ”, Prentice Hall Inc.
5. K. Subramanya, “Flow in open channels”, Tata McGraw- Hill publishing company Ltd., New Delhi.
6. Modi P.N., “Irrigation, Water resources and Water power Engineering”, Standard Book house, Delhi.
7. Bharat Singh, “Fundamentals of Irrigation Engineering”, New Chand and Bros., Roorkee, U.P

Semester – I

Elective I. HIGHWAY PROJECTS PLANNING, DESIGNING AND ECONOMIC EVALUATION

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

Highway and transport planning : roll of transport in modern society and in countries economy, modes of transport and their characteristics, history of development of road in India (Jaykar committee, Nagpur plan, road development plan 1981-2001), need for transport planning, goals

and objectives, transportation planning process -stages in transport planning - inventories, trip generation ,trip distribution, modal split, traffic assignment.

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 investigation, investigations for pavement design.

Geometric design and traffic engineering: highway cross section element, sight distance, design of horizontal alignment, design of vertical alignment, traffic characteristics, intersections, concept of level of service, PCU, parking studies, accident studies and highway safety

Pavement design and evaluation: Highway materials- aggregates, properties and test, Bitumen-properties and test, Bituminous mix design, design factors for pavements, design of flexible pavement, design of rigid pavement, deficiency in flexible and rigid pavement, methods of pavement evaluation, strengthening of existing pavements, highway maintenance, related IRC specifications.

Reinforced Earth Structures: components of reinforced earth structures, mechanism, internal and external stability of reinforced earth structures, basics of design of components of reinforced earth structures. Reinforcing of earth using geosynthetics, soil nailing (SNART), innovative highway construction material.

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- 1. Net present value(NPV), internal rate of return method, benefit cost ratio method, stages in economic evaluation, P P P Model Highway Project.

Reference Books:-

1. G.J. Pingnataro, Principles of Traffic Engineering, Mc Graw-Hill, 1970..
2. IRC publications.
3. L. R. Kadiyali " Traffic Engineering and transport planning", Khanna Publishers.
4. Jasto Khanna " Highway Engineering", Khanna Publishers.
5. Annual on Economic Evaluation of Highway Projects in India.

Semester – I

Elective II. RETROFITTING AND REHABILITATION OF STRUCTURES

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

1. An Introduction to FRP Composites in Construction, Manufacture of FRP products, Mechanical properties, Retrofitting of structures with fiber reinforced polymer: Application , Handling, storage of FRP's. Installation sequence, concrete surface preparation, Adhesive mixing, FRP installation, Protective coatings, Curing. Protective coating, Curing conditions, Common safety precautions.

2. Bonded Installation Technique Externally Bonded FRP, Wet Layup sheet, Bolted Plate, Near Surface Mounted FRP. Fundamental Debonding Mechanism Intermediate crack debonding, CDC Debonding, Plate end Debonding, Strengthening of particular floor of a structure.

3. Importance of rehabilitation as a part of construction engineering. Rehabilitation studies of buildings, underground construction, bridges, streets & highways,

4. Predictive performance models, evaluating alternatives based on technical, commercial, management, financial feasibilities, data collection and database management, maintenance of rehabilitated structures. Procedure adopted by BIFR (Board of Industrial and Financial Reconstruction)

5. Earthquake damages of buildings, their retrofitting, restoration, effects of earthquakes, response of buildings to earthquake motion, factors related to building damages due to earthquake, methods of seismic retrofitting, restoration of buildings.

Reference Books

1. GangaRao, H.V.S., Taly, N. & Vijay, P.V. (2007) Reinforced Concrete Design with FRP Composites, CRC Press Taylor & Francis Group,
2. Bank, L.C. (2006) *Composites for Construction: Structural Design with FRP Materials*, John Wiley & Sons Ltd.,.
3. Oehlers, D.J. & Seracino, R. (2004) *Design of FRP and Steel Plated RC Structures: Retrofitting Beams and Slabs for Strength, Stiffness and Ductility*, Elsevier Ltd., 228 pages.
4. Teng, J.G., Chen, J.F., Smith, S.T. & Lam, L. (2001) *FRP-Strengthened RC Structures*, John Wiley & Sons Ltd.,
5. Fundamentals of Earthquake Engineering – *N. W. Newman & E. Rosen Blueth.*
6. Masonry & Timber Structures including Earthquake Resistant Design - *A. S. Arya.*
7. Earthquake Engineering – *R. L. Wieegel.*
8. Design of Multistoried Buildings for Earthquake Ground motions - *Blume, Newmark & Corning.*
9. Structural dynamics – *Mario Paz.*
10. Rehabilitation and Retrofitting of Structures By Kb Rajoria, Ashok Basa
11. Earth Quake Engineering – Agrawal & Shrikhande

Semester – I

Elective III. PORTS AND HARBOUR STRUCTURES

Max Marks : 100 **Duration : 3.00 Hours**

Lectures : 3.00 Hrs/Week

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

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

handling.

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

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.

Port Operations: Allowable wave conditions for cargo handling, wave conditions for human safety on quays and breakwaters, forcecasting/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.).

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.

Construction Aspects : Planning and construction of expansion and renovation of existing Inland Port Infrastructure.

Sustainability: Global trade and port restructuring/reforms, impact of possible climate change scenarios, sustainable development strategies for cities and ports.

Reference Books:

1. Muir Wood, A.M., and Fleming. C.A.,“Coastal Hydraulics Sea and Inland Port Structures”, Hall stead press.
2. Ozha & Ozha, “Dock and Harbour Engineering”, Charoter Books, Anand.
3. Seetharaman, S.,“ Dock and Harbour Engineering”, Umesh Publications.
4. Richand L. Silister, “Coastal Engineering Volume I & II, Elsevier Publishers.
5. Pera Bruun, “Port Engineering”, Gulf Publishing Company

LABORATORY PRACTICE – I

Term work: 100 Marks
Oral: 50 Marks

It shall consist of 2 assignments on each of the 5 subjects of First year Term –I. Journal shall consist of these assignments. Oral shall be taken based on Term work.

SEMINAR – I

Term work: 100 Marks

Each student will select a topic in the area of Civil Engineering and related area in the state of art area and technical development. The topic will be decided by, the student, Guide and departmental research committee. Each student will make seminar presentation with audio / video aids , for the duration of 45 minutes and seminar work shall be in the form of report to be submitted by the students at the end of the semester. The report copies must be duly signed by the guide and Head of department (one copy for institute , one copy for guide and one copy for the candidate for certification). Attendance of all students for all seminars is compulsory.

Semester – II

I. CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

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.

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.

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.

Hauling & Conveying Equipment : Dump trucks and dumpers. Belt Conveyors, Screw conveyor, Bucket conveyor.

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.

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.

Reference Books :

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

7. “Construction Machinery and Equipment in India”. (A compilation of articles Published in Civil Engineering and Construction Review) Published by Civil Engineering and Construction Review, New Delhi, 1991.
8. Jay P.K. “Handbook of Construction Management” – Macmillan India Ltd., New Delhi, 1990.
9. National Building Code, ISI, New Delhi, 1983.
10. Levitt, R.E. and Samelson, N.M. “Construction Safety Management”, McGraw Hill Book Company, Inc., N.Y. 1991.
11. Adrian J.J. “Construction Productivity Improvement”, Elsevier, New York, 1987.
12. P.S. Gehlot and B.M. Dhir, “Construction Management”, (Wiley Easter). 34

Semester – II

II. SAFETY MANAGEMENT IN CONSTRUCTION

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

Construction Safety Management – Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports. Safety Benefits.

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.

Safety in use of construction equipment e.g. Vehicles, cranes, hoist and lifts etc. Safety of scaffolding and working platforms. Safety while using electrical appliances, Explosives. Prevention of fires at construction site.

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.

Study of safety policies, methods, equipment, training provided on any ISO approved construction company.

Reference books:

1. Construction Safety Manual - Published by National Safety Commission of India.
2. Safety Management in Construction Industry – A manual for project managers. NICMAR Mumbai
3. Construction Safety Handbook – *Davies V.S.Thomasin K, Thomas* (Telford, London.)
4. ISI for safety in Construction – Bureau of Indian Standards.
5. Safety management – Grimaldi and Simonds (AITBS, New Delhi)

Semester – II

III. ADVANCE CONCRETE TECHNOLOGY

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

Admixtures- Review of types and classification; chemical composition; origin and manufacture; actions and interactions; usage; effects on properties of concretes, mortars and grouts; methods of test; applications.

Durability Of Concrete And Concrete Construction- Durability concept; pore structure and transport processes; reinforcement corrosion; fire resistance; frost damage; sulfate attack; alkali silica reaction; delayed ettringite formation; methods of providing durable concrete; short-term tests to assess long-term behavior.

Mix Design-Review of methods and philosophies; mix design for special purposes, Maturity method of concrete strength assessment.

Special Concretes- Lightweight concrete: autoclaved aerated concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete. High strength concrete; refractory concrete; high density and radiation-shielding concrete; polymer concrete; fiber-reinforced concrete; mortars; renders; recycled concrete.

Special Processes And Technology For Particular Types Of Structure- Sprayed concrete; underwater concrete; grouts, grouting and grouted concrete; mass concrete; slipform construction; pumped concrete; concrete for liquid retaining structures; vacuum process; concrete coatings and surface treatments.

Ready-Mixed Concrete & Concrete Plant- Types of plant; truck-mixer efficiency; effects of prolonged agitation; quality control: acceptance and compliance. Batching plant and ancillary equipment for improving accuracy; mixers; distributing plant; vibrators.

Formwork- Principles of design; concrete lateral pressures sheeting design, soil lateral pressures, formwork for exposed concrete finishes; tolerances, shoring reshoring analysis of multistory building, Design for the cofferdam.

Precast Concrete- Review of types of small and large products; methods of compaction other than vibration; mix design and curing; special formwork requirements; masonry.

Concrete Roads- Methods and materials for pavements; cement-bound materials; testing materials.

Industrial Floors- Materials and construction procedures; screeds and toppings; testing.

Text/Reference Books

1. Concrete Technology by M. L. Gambhir, Tata Mcgraw Hill Publications.
2. Concrete Technology by M.S. Shetty, S. Chand Publications.
3. Concrete Technology by A R Santhakumar, Oxford University Press.
4. Properties of concrete by A. M. Neville, J.J.Brooks Longman Publishers.
5. Concrete Technology by R.S. Varshney, Oxford and IBH.
6. Concrete, by P. Kumar Metha, Gujrat Ambuja.

7. Concrete technology by A M. Neville, J.J. Brooks, Addison Weslley
8. Guide to formwork for Concrete, ACI -347-04 (American concrete Institute).
9. AASHTO (American society for state highway and transport officials) design guide.
10. Design Loads on Structures during Construction Standard, American society of Civil Engineers, 37-0

Semester – II

IV. ENVIRONMENT & ENERGY MANAGEMENT

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

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

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

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

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 & Labeling, Electricity Act 2003, Revisions and Present Status of Implementation

United Nations Framework Convention on Climate Change (UNFCC), Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon Funds(PCF), Carbon Credits and it's trading, Benefits to developing countries

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

Clean Development Mechanism Benefits for Energy Conservation Projects, Methodology & Procedure What is CDM? Methodology & Procedures for CDM, Eligibility Criteria, UNFCCC, Role of UNFCCC & Government of India,

Reference Books:

1. Management of Energy Environment Systems -W.K.Hall, John Wiley and Sons.
2. Energy Management and Control Systems -M.C.Macedo Jr., John Wiley and Sons.
3. Environmental Impact Analysis Handbook -J.G.Rau, D.C.Wood, McGraw Hill.
4. Energy & Environment – J.M. Fowler, McGrawHill.

5. Energy Management W R Murphy; G Mckay, B.S. Publications
6. Renewable Energy and Energy Management S C Patra; B C Kurse; R Kataki International Book Co.
7. Operations and Maintenance Manual for Energy Management, J Piper, Standard Publishers.
8. Environmental Pollution Compliance H.C. Sharma CBS Publishers.

Semester –I I

Elective I. GEOTECHNIQUES FOR INFRASTRUCTRE

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

Bearing Capacity Of Shallow Foundations: Factors affecting bearing capacity, effect of size of foundation, shape, depth & Inclination of load, load eccentricity, inclination of base of foundation, footings on sloping ground & stratified soils.

Raft Foundations- Types, loads on rafts, stiffness / rigidity of soil structure system ; allowable soil pressures for rafts in cohesion less & cohesive soils, calculation of bearing capacity of raft foundation.

Pile Foundation- Lateral load carrying capacity, introduction to p-y method and Evans & Duncan's methods. Effect of pile group on lateral load carrying capacity.

Foundations For Transmission Line Towers & Chimneys- Behavior of pad and chimney foundations, geotechnical design of chimney and pad foundation, geotechnical design of foundations for concrete towers and chimneys.

Foundations On Weak Soils: Soil improvement and foundation techniques for construction on weak and compressible soils. Foundation techniques on expansive soils, estimating heave, typical structural distress patterns.

Sheet Pile Walls & Anchored Bulkheads -Materials used, types of sheet pile walls, analysis of cantilever sheet pile walls in cohesion less & cohesive soils, stability analysis of anchored bulkheads by free & fixed earth support methods.

Drainage & Dewatering Methods - Requirements of filters used in earth dams, control of seepage through earth structures, open sumps and ditches, well point systems, deep well drainage, vacuum dewatering, electro osmosis methods, design steps for dewatering systems, capacity of pumps required. Types of drains & their components.

Reference Books :

1. Foundation Engineering by P.C. Varghese, Prentice Hall of India.
2. Foundation Analysis and Design by J.E.Bowles, Mc Graw Hill
3. Soil Mechanics and Foundation Engineering by Purushotham Raju, Pearson Education.
4. Ground Improvement Techniques by Purushotham Raju, University Science Press.

Semester – II

Elective II. RESOURCE MANAGEMENT

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

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. 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.

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. 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.

Use of (MMS) – Materials Management Systems in materials planning, procurement, inventory, control, cost control etc.

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.

Reference Books :

1. Purchasing and Inventory Control - K. S. Menon (Wheeler Publication)
2. Construction equipment planning and applications - Dr.Mahesh Verma
3. Construction planning, equipment and methods – Robert Peurifoy – (Tata McGraw Hill pub.)
4. Introduction to Human Resource Management - Biswajeet Pattanayak
5. Managing Human Resources - Bohlander & Snell

Semester – II

Elective III. URBAN HYDROLOGY AND STORM WATER MANAGEMENT

Max Marks : 100 **Duration : 3.00 Hours**
Lectures : 3.00 Hrs/Week

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, storm water modeling : Analysis of hydrologic changes due to urbanization- Approaches to study – Data collection and analysis – Probabilistic and statistical approaches. Modeling of urban water quantity – Types of models – Rainfall, Runoff modeling; urban watershed modeling (quantity) – Rational Method (or coefficient method), Runoff hydrograph, unit hydrographs –synthetic unit hydrograph. Urban watershed modeling for water quality of runoff and stream water quality.

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. 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. 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. 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).

Reference Books :

1. " Stormwater Hydrology and Drainage " by D.Stephenson, Elsevier Publications.
2. "Urban Hydrology" by J.M.Hall, Elsevier Applied Science Publishing Company.
3. "Storm water Modeling" by Overtens D.E., and Meadows M.E., Academic Press, NY.
4. "Urban Water Infrastructure Planning, Management, and Operations" by Neil S.Grigg, John Wiley & Sons.
5. "Introduction to Hydrology" by Viessman W.I., Knapp J.W., Lewis G.L., and Henbrough, T.E., Harper and Row Publishing Company.
6. "Manual of Sewerage and Sewage Treatment" Ministry of works and Housing, Government of India.
7. "Applied Hydrology", by K.N. Mutreja, Tata McGraw- Hill publishing company Ltd., New Delhi.
8. "Engineering Hydrology", by K. Subramanya, Tata McGraw- Hill publishing company Ltd., New Delhi.

LABORATORY PRACTICE – II

Term work: 100 Marks
Oral: 50 Marks

It shall consist of 2 assignments on each of the 5 subjects of First year Term –II. Journal shall consist of these assignments. Oral shall be taken based on Term work.

SEMINAR – II

Term work: 100 Marks

Each student will select a topic in the area of Civil Engineering and related area in the state of art area and technical development. The topic will be decided by, the student, Guide and departmental research committee. Each student will make seminar presentation with audio / video aids , for the duration of 45 minutes and seminar work shall be in the form of report to be submitted by the students at the end of the semester. The report copies must be duly signed by the guide and Head of department (one copy for institute , one copy for guide and one copy for the candidate for certification). Attendance of all students for all seminars is compulsory.

SEMESTER III

SEMINAR – III

Term work: 50 Marks.
Oral: 50 Marks

Each student will select a topic in the area of Civil Engineering and related area in the state of art area and technical development. The topic will be decided by, the student, Guide and departmental research committee. Each student will make seminar presentation with audio / video aids , for the duration of 45 minutes and seminar work shall be in the form of report to be submitted by the students at the end of the semester. The report copies must be duly signed by the guide and Head of department (one copy for institute , one copy for guide and one copy for the candidate for certification). Attendance of all students for all seminars is compulsory.

PROJECT STAGE I

Term work : 100 Marks

Project work will consist of development of any topic related to civil engineering.

SEMESTER IV

PROGRESS SEMINAR

Term work: 50 Marks.

This shall be based on topic of dissertation.

PROJECT STAGE II

Term work : 150 Marks
Oral : 100 Marks

Project work will consist of development of any topic related to civil engineering