

NORTH MAHARASHTRA UNIVERSITY, JALGOAN
M.E.(CIVIL)

SYLLABUS

Rules and Regulations for M.E. Course in Civil Engineering with specialization in

“Building Science and Technology”

1. The post graduate degree in Engineering consisting of 2 years (4 terms) shall be designated as ‘Master of Engineering in Civil Engineering with specialization in Building Science and Technology.’
2. A candidate may be permitted to register himself for the M.E. degree in civil Engineering with specialization in Building science and Technology under the faculty of Engineering of North Maharashtra University, Jalgaon only if the candidate holds a Bachelor’s Degree in Engineering/ Technology of North Maharashtra University, Jalgaon or its equivalent in Civil Engineering, construction Engineering recognized by AICTE, and North Maharashtra University, Jalgaon.
3. The students shall be admitted to second term of first year if his term is granted.
4. The students shall be admitted to second year if his second term of first year is granted . However he will not be allowed to submit his thesis / dissertation unless he has cleared all the theory papers and has completed all the presentations of first term of second year.
5. Every student will be required to produce a record of laboratory work in the form of journal, duly certificate for satisfactory completion of the term work by the concerned teacher and head of the department.
6. A student whose term is not granted on account of unsatisfactory attendance / term work is required to repeat the semester.
7. Each student is required to present seminar in the first term of second year on the state of the art of the topic of his / her choice.
8. Each student is required to deliver a seminar in the first term of second year the work done purposed to be done for his / her dissertation which will be evaluated by committee consisting of guide and 2 faculty members of the department appointed by the Director / principal of the college.
9. Minimum passing marks for all the theory papers shall be 40% and for term work and seminar and project presentation shall be 50%. A candidate is required to get an average of 50% marks in aggregate in the each term.
10. The class will be awarded on the basis of marks of all the terms, giving equal weightage to all terms as shown below...
 - 50 to 59 % marks in aggregate- II class
 - 60 to 69 % marks in aggregate – I class
 - 70 % and above marks in aggregate – I class with distinction.
11. Each student is required to complete his master’s degree within five academic years from the date of admission, failing which he / she will be required to take fresh admission in first year.

Structure of M.E. (Civil)
Building Science And Technology
SEMESTER – I

Sr. No.	Subject	Teaching Scheme		Examination Scheme				
		Hours/week		Paper Duration hours	Maximum Marks			
		Lectures	Practical		Paper	TW	PR	OR
1	Building Environ & Services	3	1	3	100	50		
2	Constru. & Project. Management	3	1	3	100	50		
3	Advance Design of Concrete Structures	3	1	3	100	50		
4	Contracts & Valuation	3	1	3	100	50		
5	Elective - I	3	1	3	100	50		
Total		15	5		500	250		
Grand Total		20			750			

List of Subjects for Elective- I

- 1) Operation Research
- 2) Environmental Risk Assessment & Hazard Management.
- 3) Work study and Incentive Management.

Structure of M.E. (Civil)
Building Science And Technology
SEMESTER – II

Sr. No.	Subject	Teaching Scheme		Examination Scheme				
		Hours/week		Paper Duration hours	Maximum Marks			
		Lectures	Practical		Paper	TW	PR	OR
1	Construction Tech. & Equipments.	3	1	3	100	50		
2	Earthquake Resist. Design of Building	3	1	3	100	50		
3	Low Cost Housing.	3	1	3	100	50		
4	Construction cost Dynamics.	3	1	3	100	50		
5	Elective - II	3	1	3	100	50		
Total		15	5		500	250		
Grand Total		20			750			

List of Subjects for Elective- II

- 1) Probability, Statistics & Optimization Technique.
- 2) Architecture And Town Planning..
- 3) Environment Impact Assessment.

Structure of M.E. (Civil)
Building science and technology
SEMESTER – III

Sr. No.	Subject	Teaching Scheme		Examination Scheme				
		Hours/week		Paper Duration hours	Maximum Marks			
		Lectures	Practical		Paper	TW	PR	OR
1	Seminar –I	-	1	-	-		50	
2	Seminar II	-	1	-	-		50	
3	Project Stage I	-	2	-	-		100	
Total		-	4	-	-		200	
Grand Total					200			

Structure of M.E. (Civil)
Building science and technology
SEMESTER – IV

Sr. No.	Subject	Teaching Scheme		Examination Scheme				
		Hours/week		Paper Duration hours	Maximum Marks			
		Lectures	Practical		Paper	TW	PR	OR
1	Project Stage I	-	-	-	-	-	-	-
2	(Final Stage)Project	-	2	-	-	100	100	100
Total		-	2	-	-	100	100	100
Grand Total					300			

Grand Total = 2000

BUILDING ENVIRONMENT & SERVICES

Lectures :- 03 Hours / Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

1.
 - a) Acoustics, Acoustical Designs, Noise & its control.
 - b) Natural and Artificial Light in Building, Lighting, Measurements. Design of Lighting System.
 - c) Fire protection of Buildings.
2.
 - a) Energy conservation in Buildings, Thermal properties of building, Thermal insulation & Insulating material, Thermal design of enclosures.
 - b) Thermal Environment inside building, cooling and heating loads, Systems of air-conditioning.
3.
 - a) Principal of non – conventional energy systems.
 - b) Elevators, Escalators and conveyers, Design, Types, Location, bye-laws etc.
 - c) Electric wiring system in building, conductors, cable and conduits, Electrical grounding in buildings.
4.
 - a) Water supply to building
 - Water supply systems for buildings.
 - Domestic and commercial Hot water and water supply system for multistoried buildings.
 - b) Swimming pools – Design criteria, Springboards, pressure filters for recirculation., maintenance.
5.
 - a) Building Drainage system.
 - Nature of Drainage phenomenon,
 - Antisiphon & vent piping,
 - Installation, jointing & testing of pipes,
 - b) External drainage system in building.
 - c) Domestic gas supply – characteristics of gas services & distribution piping.
 - d) Approval of authorities for water supply & sanitary schemes for buildings.
 - e) Roof water harvesting & water conservation.

Term Work: - Any five assignment based on above syllabus.

Reference Books: -

1. National Building code, Bureau of Indian standard.
2. Acoustical designing in Architecture, by V.O. Kusen & C.M. Harris, John Wiley & Sons.
3. Acoustic – Design & practice , by R.L. Suri, Asia Publishing House.
4. Architecture acoustics, by Anita Lawrence.
5. Main climate & Architecture, by B. Govoni, Elsevier publishing co.
6. Thermal performance of buildings, by J.P. Van Stratten, Elsevier Publishing, Co.
7. Functional requirements of buildings (other than Industrial Buildings) , BIS Handbook.
8. Fundamentals of Industrial ventilation, by V.V. Baturin , Pergoan press.
9. National plumbing Code, by V.T. Manas , McGraw Hill Book co.
10. Standard plumbing Engineering Design , McGraw Hill Book Co.
11. Building research station Digest , London.
12. Water supply & sanitary installation – Design , Construction & Maintenance , by Panchdhari , New Age International Ltd., New Delhi.
13. Manual of water supply & treatment, Ministry of Health, Govt of India.
14. Electrical Design estimating & costing , by K.B. Raina & S.K. Bhattacharya.

CONSTRUCTION AND PROJECT MANAGEMENT

Lectures :- 03 Hours / Week.

Tutorial :- 01 Hours / Week.

Term Work :- 50 marks.

Theory :- 100 marks.

Min Passing –40 marks.

Duration:- 3 Hours.

A) *Organizational Methods:-*

The basic form of management, Historical evaluation of management, Contributions by different engineers/ scientists, Types of organizations.

B) *Network Analysis:-*

Introduction to network techniques (CPM & PERT) Compression, Updating, resource Levelling, resource allocation, Cost control, E-L envelope, Financial planning.

Project Management:-

Project formulation, Identification of investment analysis, Cash flow of the projects, Appraisal criteria & selection of investments.

A) *Quality Control:-*

Quality control, theory, sampling techniques, statistical methods, acceptance control methods, quality management and economics, quality circles.

B) *Job Evaluation:-*

Basic procedure, Rankine system , Point system, packaged point system, Grading method, Factor comparison method.

Personnel Management:-

Functions, Human resources, development, Placement & training, personnel records, reports, performance appraisal.

Tutorials / Assignment:- Assignments based on above topics to be submitted.

References Books :-

1. Personnel Management – Beach
2. Personnel Management & Industrial Relations- Davar.
3. Principals of Management & personnel Management- A.S. Deshpande.
4. Personnel Management & Industrial Relations – Date.
5. Personnel Management & Organizational Behaviour – Gokhale.
6. Personnel A New approach Management – Torrington H.A.
7. Personnel Management – Flippo.
8. Quality control – D Paralithaman – Tata McGraw hill.
9. Quality Circle in India – S.R. Udpa.
10. A Management roll for Quality control – John T. Hagan.
11. Total Quality Management – H. Lal – Wiley Eastenn Ltd.
12. Statistical Quality control – Grant Leavenworth.
13. Personnel Management – C.B. Mamoria.
14. Mechanical & Electrical Equipments for Building – (vol.I & II)- Reryamin.
15. Project preparation appraisal implementation – Chandra.
16. Critical path methods in construction practice.
17. CPM in construction Management – by J.J. Rohan.
18. Principal of management by Koonthz.
19. Scientific Management by Taiyor.
20. Construction project management – Benett J, Butterworths , London.
21. Project Management with CPM & PERT – Modetr J.J. & Phillips C.R.
22. Probability, Statistics & Decision for Civil Engineers – Benjamin J.R. & Cornett C.A. , Tata McGrew hill.
23. Cost & optimization Engineering – Jelen J. McGrew hill.

24. Construction & Project Management- Appraisal & Control of project cost – Pilcher Roy – editor K.N. Vaid & Rajeev Nehra.
25. Principals of construction managements- Roy Pilcher.

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ADVANCED DESIGN OF CONCRETE STRUCTURES

Lectures :- 03 Hours /Week.
 Tutorial :- 01 Hours / Week.
 Term Work :- 50 marks.

Theory :- 100 marks.
 Min Passing –40 marks.
 Duration:- 3 Hours.

Yield line theory for slabs. Circular slab. Flat slabs. Grid slabs, Beams curved in plan, Circular & conical domes, Cylindrical shells, Design of pile foundation, Composite sections, Design of formwork, High performance concrete, Mix Design, Crcep, ,Fatigue & Shrinkage, Concreting under special conditions, Methods of Non destructive testing.

Term – Work / Assignment:-

Shall consist of any 5 Problems based on above syllabus.

References Books :-

- 1) A complete guide to demolition – D.N. Pledger.
- 2) Advanced reinforced concrete design – P.C. Verghese (Prentice – Hall)
- 3) Fundamentals of Reinforced concrete – N.C. Sinha & S.K. Roy (S. Chand)
- 4) Advanced Reinforced concrete Design- N. Krishnaraju.
- 5) Plain & Reinforced Concrete by O.P. Jain & Jai Krishna.

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CONTRACT AND VALUATION

Lectures: - 03 Hours /Week.
 Tutorial: - 01 Hours / Week.
 Term Work: - 50 marks.

Theory: - 100 marks.
 Min Passing:- 40 marks.
 Duration: - 3 Hours.

1. Valuation , immovable property.
 - Value, types, Building cost Index, Wealth, Capital Gain.
 - Depreciation.
 - Property, its types, Mortgage.
2. Various acts related to valuation
 - Methods of valuation.
 - Valuation of free hold & lease hold properties, Valuation of Mortgaged proper lies, etc.
 - Valuation of land, agricultural land.

3. Valuation according to purposes.
 - Rent fixation.
 - Valuation of other assets.
4. Contract.
 - Types of contract.
 - Acts related to contracts.

Term Work:- Assignments based on above syllabus to be submitted.

Reference Books :-

1. Property valuation by Roshan Namavati.
2. Property valuation by S.C. Rangwala.
3. Income tax Act & other acts.
4. Various journals of Institution of valuers.
5. A complete Guide to Demolition – pledge D.N.
6. Is – 1256, 3696 (I & II), 3764, 4130, 4014 (I & II)

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ELECTIVE – I
ENVIRONMENTAL RISK ASSESMENT AND HAZARD MANAGEMENT

Lectures :- 03 Hours / Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

Types of hazardous work
Health effects
Cradle to grave management
Treatment methods
Final Disposal
Risk Assessment

Formulation of objective functions and construction for Env. Engg. planning design.
Simulation models and its application to ESA (Env. System analysis)
Introduction to expert system, neural network and genetic algorithm.

Term Work /Assignment:-

Shall consist of any 5 problems based on syllabus.

ELECTIVE – I
OPERATION RESEARCH

Lectures :- 03 Hours / Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

Introduction to operation Research (O.R.), mathematical models in Operation Research , Linear programming problem, Mathematical formulation, Graphical solution's, Simplex method's, Duality in linear programming sensitivity analysis, Assignment and Routing problem, Transportation problem, Formulation and optimal solution.

Non linear Programming problem's, One dimensional elimination method for single, variable problem's, Descent methods for multivariable unconstrained problems, Lagrange's method & Kuhn Tucker condition for multivariable constraints problem. Sequencing model, Dynamic programming formulation and solution.

Term Work:- Assignments based on above syllabus to be submitted.

Reference Books:-

1. Operation Research – principals & practice- Ravindrain , Philips, Solberge John Wiley & Sons.
2. Operation research & introduction by Taha- Tata Mc-Grew hill.
3. Principals of operation research – Wagner- prentice hall of India.
4. Optimization theory & application- by S.S. Rao – Wiley hastern Ltd.
5. Operation research by Kanti Swarup & P.K. Gupta – S. Chandr.
6. Optimization methods in O.R. – by K.V. Mital & C. Mohan – New an Indo Publication.

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ELECTIVE – I
WORK STUDY & INCENTIVE MANAGEMENT

Lectures :- 03 Hours /Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

1. The evolution of work study – F.W. Taylor, Gilbreth.
Definitions, Objective, Basic procedure of work study, method study work measurements, work content, productivity & work study, work study & its applications to Civil Engineering.
2. Method study :- Definition , objective, procedure, selecting the work, recording facts, Process chart, symbols , flow process chart other types of charts and diagrams, cycle graph , chronocyclegraph.

Micro motion Study:-

3. Work Measurement:- Time stud , concept of various allowances , standard time, performance rating, Time study equipment, activity sampling, PMTS, Analytical estimating, Work specification, production studies.
4. Application of Work Study:- The human context of work study , Work study as a service to management, limitations of work study criticism of time stud , Training of personnel's in work study.

5. Standard of living, what and why the driving force of incentives Admission of incentive schemes... Incentive index & productivity allowances geared schemes , piece work activity sampling field counts, rating , job evaluation, installation of incentive systems, place of Union.

Term Work:- Assignment based on above syllabus to be submitted.

The work improvement & system concept, causes of failure of incentive schemes.

Reference Books :-

1. Work study – R.M.Currie.
2. Work study applied to buildings – Gearry.
3. Project planning & Control – Turner & Elloit.
4. Introduction to work study – ILO.
5. Motion & Time study – Mundel.
6. Incentive Management – Lincon.
7. Incentive Management – S.S. Snd.
8. Work study & Ergonomics – L.C. Jhamb.
9. Motivating economic achievement – Me Clelland & winter.

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SEMESTER – II
CONSTRUCTION TECHNIQUES AND EQUIPMENTS

Lectures :- 03 Hours / Week.

Tutorial :- 01 Hours / Week.

Term Work :- 50 marks.

Theory :- 100 marks.

Min Passing –40 marks.

Duration:- 3 Hours.

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1. Construction Equipments – I
 - a) Excavating equipments.
 - b) Hauling equipments.
 - c) Compacting equipments.
 - d) Conveying & hoisting equipments.
 2. Construction Equipments – II
 - a) Pile driving equipments.
 - b) Explosives & blasting equipments.
 - c) Crushers.
 - d) Concreting equipments including plant.
 3. Management & maintenance of construction equipments.
 4. Foundation Engineering- Different types of foundations, damages due to construction operation.

Tutorials / Assignment :- Assignments based on above topics to be submitted.

References Books :-

1. Construction planning, Equipments & methods – R.L. Peurifoy.
2. Industrialized buildings, 50 international systems, Vol. I, II, III, life Books Ltd. London.
3. National Building Code 1983.
4. NBO Hand Book for Civil Engineers.
5. Modern Foundations – N.P. Kurion , Tata Mc-Grew hill.

6. Foundation Engineering – G.A. Leonards – Tata Mc-Grew hill.
7. Hand book of Civil Engineering – Stubb.
8. Foundation Engineering – Tomlinson.
9. Moving the Earth- Herbert L. Nichols – D. Van, Nostrand Co., Inc New Tersey.
10. Hand book of earth- moving machinery (Ministry of Irrigation & Power, control water & power Commission, New delhi).
11. Construction Methods & Machinery – Kellog- Prentice hall Inc. New York.
12. Construction planning & plant- Ackerman & Locher – Mc-Grew hill.
13. Construction equipments & its planning & Application – Verma. Mahesh – Metropolitan book Co. Pvt. Ltd. New Delhi.
14. On & with the Earth – Jagntan Singh – W. Newman & Company , Calcutta.
15. Construction Planning & Management through system Techniques- Verma M., Metropolitan book Co. P. Ltd., New Delhi.
16. Construction Equipment Guide – David Day.
17. Construction Machines & Equipment Manufactured in India – National.
18. Earth Moving Plast – V.V. Tucker.
19. Construction Equipment – Dombrovsky.

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EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

Lectures :- 03 Hours / Week.

Tutorial :- 01 Hours / Week.

Term Work :- 50 marks.

Theory :- 100 marks.

Min Passing –40 marks.

Duration:- 3 Hours.

Introduction to Engineering Seismology , Nature & Causes of earthquake.

Earthquake ground motion & response spectra, intensity & magnitude. Building systems symmetry & Ant symmetry. Estimation of Gravity & Lateral loads. Seismic coefficient method & Response spectrum method. Design code provisions.

Design of Multi storied buildings, Detailing of members & joints, shear wall .

Design of foundations. Study of I.S. Codes, application of computer software's.

Term Work:- Design of building with more than 10 store's for earthquake load. It should consist of project report & 2 half Imperial size sheets showing typical details on members & joints.

Reference Books :-

1. Dynamics of Structures – A.K.Chopra.
2. Advanced Reinforced concrete Design – P.C. Verghese . (prentice – Hall).

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LOW COST HOUSING

Lectures :- 03 Hours / Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

1.Housing Situation in India:-

The need for low income housing, strategies for housing urban poor, national Housing policy.

2.Low Cost and alternative construction materials.:

Soil fly ash, Silica fumes, Ferro cement, recycled aggregates, cellular concrete fly ash bricks, fly ash concrete, hollow concrete blocks, building material from agricultural and industrial waste, plastics, etc.

3. Development of Low cost Housing Technology:

Cost effective Housing Techniques, pre cast elements prefabrication of mass Housing, Economical walling systems.

4.Low cost Infrastructure Services:

Low cost Sanitation, Domestic Waste disposal, Water supply

5.Rural Housing

Appropriate rural Housing Technology, Mud House Technology

6. Housing In Disaster Prone Area

Damages to Houses, Repair and Restoration of Earthquake damaged Non Engineered buildings, Recommendation for future construction

Term Work: *Assignments* based on above syllabus to be submitted

Reference Books:-

1. Low Cost Housing by A K Lal
2. NBO Hand Book New Delhi.

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ELECTIVE – II
ARCHITECTURE AND TOWN PLANNING

Lectures :- 03 Hours / Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

Course Contents:-

Introduction. History & concept of Architecture. Urban & landscape design, Advance planning theory & practice.
Town Planning & its scope , planning for Transportation & utility services. Social formation & Housing. Law in relation to planning , Urban renewal , conservation & planning for rural development . Economic aspect of planning & computer programming.

Term Work:-

1. Sub division of plots, junction improvement.
2. Town Planning Schemes.
3. Study & reports on life important town planner & architects.

ELECTIVE – II
ENVIRONMENT IMPACT ASSESSMENT

Lectures :- 03 Hours / Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

Defination & explanation of Environmental Impact Assessment.
Elements of E.I.A – Environmental Attribute.
Air, water, Noise, Land.
Methodologies of E I A.
Techniques of Analysis.
Special issues in E I A , Public participation, Environmental Health Impact Assessment
Methodology.
Environmental Audit.
Introduction to Energy Audit.
Introduction to water Audit.

Term Work : Any five assignments based on the above topics.

Reference Books:-

Handbook of E I A.
Jain R.K. etal “ Environmental Impact Analysis”.
Heer janu I etal Environmental Impact Assessment & Management”.

SEMESTER III & IV
SEMINAR – I

Exam Scheme :

Presentation: 50 Marks.

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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.

SEMINAR – II

Exam Scheme :

Presentation: 50 Marks.

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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 WORK

Exam Scheme :

Stage – 1 : Presentation - 100 Marks.

Term work : 100 Marks

Stage – 2 : Presentation - 100 Marks.

Oral : 100 Marks

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

ELECTIVE – II
PROBABILITY, STATISTICS & OPTIMIZATION TECHNIQUE

Lectures :- 03 Hours / Week.
Tutorial :- 01 Hours / Week.
Term Work :- 50 marks.

Theory :- 100 marks.
Min Passing –40 marks.
Duration:- 3 Hours.

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Probability & Statistics:

Concept of probability, Random Variable, Distributio, Some special distribution such as binomial, poisson, negative binomial, geometric, uniform normal, exponential, gamma, beta, log normal & person, moments, moment generating fuction, sampling technique, sampling distributions, point and interval estimation, testing of hypothesis, analysis of variance, concept of design of experiments, bivariate distributions, independence, correlation & regressions.

Optimization Technique:

Mathematical formulation of optimization problems & their general methods of solution. Multi-objective and goal programming problems using graphical method. Fibonacci method, Method of steepest descent, Hooks & jeeves Method, Conjugate gradlent method, Principal of Optimality & method of recursive optimization.

Term Work:-

Total six assignment, minimum three from probability & statistics & three from optimization technique.

REFERENCES:-

- 1.“ Mathematical Statistics “ by Wilkis SS, John Wiley & Sons.
- 2.“Probability & Statistics “ by Johnson R. Miller, Printice Hall of India.
- 3.Applied Numerical methods for Engineers “ by Schilling Harris, Thompson.
- 4.Optimization Theory & Application” by Rao SS , Wiley Eastern.
- 5.“Operation Research “ by Mustafi New Age.

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CONSTRUCTION COST DYNAMICS

Lectures :- 03 Hours / Week.

Tutorial :- 01 Hours / Week.

Term Work :- 50 marks.

Theory :- 100 marks.

Min Passing –40 marks.

Duration:- 3 Hours.

1. Principal of Engineering Economics:
Factors involved, study of present economy, capital investment interest, present worth sinking fund deposit factor, uniform gradient series.
2. Economic Comparisons:
Financing projects, methods of economy study, capitalized costs, Discounted Cash Flow (DCF) methods such as return on capital, payback, yield method, comparison of various methods, breakeven cost analysis, cost composition, cost comparison.
3. Determination of building costs:
The cost implication of different forms of construction and maintenance and replacement lives of materials, installation and running costs of services, cost analysis by traders and by functional elements, techniques of cost planning, cost control during design, documentation and construction.
4. Risk and Uncertainty Analysis :
Analysis of risk and uncertainty , calculation of cost of hazard.
5. Capital investment decision, technique of capital budgeting, cost of capital, decision making systems for capital investments, stock exchange, types of securities, borrowings, loan capital, public deposit, dividend policies, cost analysis for control, relevant costs and irrelevant costs, cost allocation for project decision making.
6. Budgetary control systems, types of budgets, procedure for master budgets, key factor, budget manual cash flow forecasts.

Reference Books:

1. “Cost and Optimisation Engineering” by jeher . j.
2. “Project Management with CPM and PERT” by moder, J.J. & Philips, C.R.
3. “Probability , Statistics, & Decision for Civil Engineers” by Benjamin, J.R. and cornell G.A.
4. ‘Appraisal & Control of Project Cost’ by pilcher R.
5. Build Cost , Building Construction Cost Data – Compiled by integrated Project Management Group Ltd – Tata McGrew , Hill Publishing Co.
6. Value Design Construction – O. Brien James.
7. Value Engg. & Practical approach for Owner, Designers, & Contractors by Zimmarman , Larry & Hart G.D.

8. Value Engineering – Lawrence Miles.