

Faculty of Engineering – scheme & syllabus of M.Tech course in
Construction Engineering & Management – approved – implemented –
Orders issued.

GENERAL AND ACADEMIC BRANCH – IV ‘E’ SECTION

No.GAIV/E1/8226/2011
.10.2012.

Dated: Calicut University P.O., 10

- Read: 1. U.O. of even number dated 24.04.2012.
2. U.O. of even number dated 18.06.2012.
3. U.O. of even number dated 24.07.2012.
4. Minutes of the meeting of Board of Studies in Engineering(PG)
held on 10.08.2012 (item No. 5).
5. E-mail letter from the Chairman of the Committee constituted
for framing the said syllabus dated 04.10.2012.
6. Orders of Vice Chancellor in the file of even number on
11.09.2012.

ORDER

As per paper read as (1) above, a committee was constituted for framing
the scheme and syllabus for the M.Tech course in Construction Engineering
& Management with the following members.

- 1) Dr.Kouzer.K.M., Department of Civil Engineering, Government
Engineering College, Kozhikode.
- 2) Dr.Babu.K.K., Principal, Thejus Engineering College, Vellarakad,
Erumapetti (P.O.), Thrissur.
- 3) Dr.Sashidharan, Department of Civil Engineering, NSS
Engineering College, Palakkad.

Vide paper read as 2nd above, the committee was reconstituted with the
following members for the framing of the scheme and syllabus of M.Tech.
course in Construction Engineering & Management.

- 1) Dr.Babu.K.K., Principal, Thejus Engineering College, Vellarakad,
Erumapetti (P.O.), Thrissur.
- 2) Dr.Sashidharan, Department of Civil Engineering, NSS Engineering
College, Palakkad.
- 3) Dr.E.K.Kunjanandan Nambiar, Associate Professor, Department of
Civil Engineering, NSS College of Engineering, Palakkad.
- 4) Sri.R.Radhakrishnan, Department of Civil Engineering, NSS College of
Engineering, Palakkad.

5) Sri.Mathew.C.George, Principal, Calicut University Institute of Engineering & Technology, Kohinoor, University of Calicut.

Vide paper read as 3rd above, Dr.E.K. Kunjanandan Nambiar was nominated as the Chairman of the above committee constituted for the framing of the aforesaid scheme and syllabus.

Vide paper read as 4th above, the meeting of Board of Studies in Engineering (PG) held on 10.08.2012, vide item No.5, unanimously resolved to approve the scheme and syllabi of the M.Tech course in Construction Engineering & Management submitted by the expert committee with the following corrections.

- a) As the M.Tech. course is as per Regulations with effect from 2010, it is suggested to commence all the subject-codes CEM10 instead of CEM12.
- b) In scheme, title of subject CEM12 105(D) is Maintenance and Rehabilitation of Buildings, where as in syllabus it is given as Maintenance and Rehabilitation of Structures. This mistake shall be corrected.
- c) CEM12 107(P) – Seminar in scheme shall be corrected as CEM10 107(P) Seminar I.
- d) Name of College on title page shall be removed as the scheme and syllabi is approved for the University.
- e) Recent books shall be included in syllabi of subjects like CEM10 105(D), CEM10 202, CEM10 302(B).

Considering the urgency of the matter the Vice Chancellor has accorded sanction to implement the scheme and syllabus of the M.Tech. course in Construction Engineering & Management, subject to ratification by the Academic Council, vide paper read as 5 above.

The Chairman of the committee was requested to make the corrections as resolved by the Board and accordingly the Chairman had forwarded the scheme and syllabus of the M.Tech. course in Construction Engineering & Management effecting the corrections; vide paper read as 6th above.

Sanction has therefore been accorded for implementing the scheme and syllabus of the M.Tech. course in Construction Engineering & Management with effect from 2010 admissions.

Orders are issued accordingly.

The syllabus is available in the University website.

Sd/-

ASSISTANT REGISTRAR (G&A-IV)

For **REGISTRAR**

To

The Principals of all affiliated colleges offering M.Tech. course.

Copy to:

PS to VC/PS to PVC/PA to Registrar/

PA to CE/ System Administrator (with a request
to upload in the University website)Enquiry/

Ex Section/ EG Section

DR-M.Tech/M.Tech Tabulation Section/

Dean, Faculty of Engineering/ch'man,

BOS in Engg(PG)

Forwarded/By order

Sd/-

SECTION OFFICER

CURRICULUM, SCHEME AND SYLLABI
of
M.Tech. Course
in
CONSTRUCTION ENGINEERING AND MANAGEMENT
(CIVIL ENGINEERING)



UNIVERSITY OF CALICUT
(2010 Admission onwards)

Scheme and Syllabi for M.Tech. Programme in
Construction Engineering and Management

Semester 1

Course Code	Subject	Hours/Week			Marks		Total Marks	End sem Exam Duration	Credits
		L	T	P/D	Internal	Sem-end			
CEM10 101	Applied Statistics & Queuing Theory	3	1	0	100	100	200	3	4
CEM10 102	Modern Construction Materials, Methods and Equipments	3	1	0	100	100	200	3	4
CEM10 103	Quality Control & Project Safety Management	3	1	0	100	100	200	3	4
CEM10 104	Contract Laws & Regulations	3	1	0	100	100	200	3	4
CEM10 105	Elective I	3	1	0	100	100	200	3	4
CEM10 106(P)	Advanced CAD Lab	0	0	2	100	0	100		2
CEM10 107(P)	Seminar I	0	0	2	100	0	100		2
	Departmental assistance			6					
	Total	15	5	10	700	500	1200		24

L-Lecture; T-Tutorial; P-Practical; ICA-Internal Continuous Assessment; ESE-End Semester Examination

ELECTIVE I

CEM10 105 (A) Energy Conservation Techniques in Building Construction

CEM10 105(B) Advanced Concrete Technology

CEM10 105(C) Quantitative Techniques in Management

CEM10 105(D) Maintenance and Rehabilitation of Buildings

Semester 2

Course Code	Subject	Hours/Week			Marks		Total Marks	End sem Exam Duration	Credits
		L	T	P/D	internal	Sem-end			
CEM10 201	Construction Planning, Scheduling & Control	3	1	0	100	100	200	3	4
CEM10 202	Construction Personnel Management	3	1	0	100	100	200	3	4

CEM10 203	Construction Economics and Finance Management	3	1	0	100	100	200	3	4
CEM10 204	Elective II	3	1	0	100	100	200	3	4
CEM10 205	Elective III	3	1	0	100	100	200	3	4
CEM10 206(P)	Mini Project	0	0	2	100	0	100		2
CEM10 207(P)	Seminar II	0	0	2	100	0	100		2
	Departmental assistance			6					
	Total	15	5	10	700	500	1200		24

L-Lecture; T-Tutorial; P-Practical; ICA-Internal Continuous Assessment; ESE-End Semester Examination

ELECTIVE II

CEM10 204 (A) Computer Applications in Construction Engineering and Planning

CEM10 204 (B) Management Information System

CEM10 204 (C) Eco-friendly Constructions

CEM10 204 (D) Advanced Construction Techniques

ELECTIVE III

CEM10 205 (A) Shoring, Scaffolding and Formwork

CEM10 205 (B) System Integration in Construction

CEM10 205 (C) Reuse & Recycle Technology

CEM10 205 (D) Smart Materials and Smart Structures

Semester 3

Course Code	Subject	Hours/Week			Marks		Total Marks	End sem Exam Duration	Credits
		L	T	P/D	internal	Sem-end			
CEM10 301	Elective IV	3	1	0	100	100	200	3	4
CEM10 302	Elective V	3	1	0	100	100	200	3	4
CEM10 303	Industrial Training	0	0	6	50	0	50		1
CEM10 304	Master Research Project (Phase-1)	0	0	10	150*+150*	0	300		6

	Departmental assistance			6					
	Total	6	2	22	550	200	750		15

*Guide and Evaluation Committee

Lecture; T-Tutorial; P-Practical; ICA-Internal Continuous Assessment; ESE-End Semester Examination

ELECTIVE IV

CEM10 301 (A) Disaster Management

CEM10 301 (B) Materials Management

CEM10 301 (C) GIS in Construction Engineering and Management

CEM10 301 (D) Construction Project Management

ELECTIVE V

CEM10 302 (A) Building Services

CEM10 302 (B) Resource Management and Control in Construction

CEM10 302 (C) Pavement Construction Practice

CEM10 302 (D) Management Principles and Risk Analysis

Semester 4

	Subject	Hours/Week			Marks		Total Marks	End sem Exam Duration	Credits
		L	T	P/D	Internal	Sem-end			
CEM10 401	Master Research project (Phase -2)	0	0	24	150*+150*	150 [@] +150 [@]	600	0	12
	Departmental assistance			6					
	Total	0	0	30	300	300	600	0	12

*Guide and Evaluation Committee

@External Evaluation and Viva Voce

GRAND TOTAL FOR ALL SEMESTERS

Total credits	75
Total Marks	3750

Semester 1

CEM10 101 Applied Statistics and Queuing Theory

Hours per week: Lecture-3 and Tutorial-1

Objective

To enable the students to apply statistics in various areas of construction engineering and management like sampling and analysis, stochastic modeling etc.

Module I Basic Concepts of Queuing Theory (13 hours)

Probability-Random variables-Moments-Moment generating functions-standard distributions-Functions of Random Variables--Two dimensional random variables-correlation and regression

Module II Estimation Theory (14 hours)

Principles of Least squares-Multiple and partial Correlation-Regression -Estimation of parameters-Maximum likelihood estimates-Method of moments

Module III Testing of Hypothesis (13 hours)

Sampling of distributions-Test based on Normal, t-, chi-square and F distributions-Analysis of variance-one way and two way classifications

Module IV Design of Experiments & Queuing Theory (14 hours)

Completely Randomized Design-Randomized Block Design-Latin square design-2 square Factorial design-Single and Multiple server Markovian Queuing Models

References:

1. Taha, H.A., " *Operations Research: An Introduction* ", Prentice - Hall of India, 6th Edition, New Delhi, 1997.
2. Freund, J.E. and Miller, I.R., " *Probability and Statistics for Engineers* ", Prentice - Hall of India, 5th Edition, New Delhi, 1994.
3. Gupta, S.C. and Kapur, V.K., " *Fundamentals of Mathematical Statistics* ", Sultan Chand & Sons, New Delhi, 1999
4. Goel B.S., and Mittal, S.K., " *Operations Research* ", Pragati Prakashan, Meerut, 2000.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 102 Modern Construction Materials, Methods and Equipments

Hours per week: Lecture-3 and Tutorial-1

Objective

To enable the students familiarize with modern construction materials, methods, equipments and their applications

Module I Modern Construction Materials (11 hours)

Study Of Advance Building Materials like, aluminium, glass, fabric, various types of finishes & treatments, Construction chemicals – sealants, engineering grouts, mortars , admixtures and adhesives

Module II (15 hours)

Polymers in Civil Engineering-Structural Plastics And Composites- Polymer Membranes-Coatings-Adhesives, Non - Weathering Materials-Flooring And Facade Materials- Glazed Brick, Photo Catalytic Cement, Acid Etched Copper And Composite Fiber

Metals-Metals And Special Alloys Of Steel - Water Jet Cut Stainless Steel, Mill Slab Steel, Tension Rods Assemblies And Cast Iron, Heat Treatment In Steels, Tendons.

Module III Construction methods (14 hours)

Precast Flat Panel System, 3d Volumetric Construction, Tunnel Boring Methods, Precast Foundations .Fabrication Of Pre Cast And Pre Stressed Components, Reinforcing Steel: Types, Bending, Placing, Splicing And Spacing, Tendons- Soil Improvement - Mechanical, Thermal And Chemical.

Module IV Construction Equipments (14 hours)

Equipment for Excavating, Dredging, Trenching, Tunneling, Drilling, Blasting-Equipment for compaction-Erection Equipment- Types of pumps used in construction-Equipment for Dewatering and Grouting-Foundation and Pile Driving Equipment , Forklifts and related Equipment-Portable Material -Conveyors-Hauling Equipment

References:

1. Shan Somayaji, " *Civil Engineering Materials* ", 2nd Edititon , Prentice Hall Inc., 2001.
2. Mamlouk, M.S. and Zaniewski, J.P., " *Materials for Civil and Construction Engineers* ", Prentice Hall Inc., 1999.
3. Derucher, K.Korfiatis. G. and Ezeldin, S., " *Materials for Civil and Highway Engineers* ", Prentice Hall Inc., 1999. 4th Edition
4. Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., " *Construction Planning, Equipment and Methods* ", 5th Edition, McGraw Hill, Singapore, 1995.
5. Sharma S.C. " *Construction Equipment and Management* ", Khanna Publishers New Delhi, 1988.
6. Deodhar, S.V. " *Construction Equipment and Job Planning* ", Khanna Publishers, New Delhi, 1988.
7. Dr. Mahesh Varma, " *Construction Equipment and its Planning and Application* ", Metro-politan Book Company, New Delhi-, 1983.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 103 Quality Control & Project Safety Management

Hours per week: Lecture-3 and Tutorial-1

Objective

To study the concepts of quality and assurance and control techniques in construction

Module I (14 hours)

Construction Organization Types of Organization-Inspection, Control and enforcement-Quality Management Systems and Method- Responsibilities and authorities in Quality assurance and Quality control-Architects, Engineers, Contractors, and Consultants, Quality circle

Quality Management: Quality policy, Objectives and methods in construction industry-Consumer satisfaction-Ergonomics-Time of Completion-Statistical Tolerance-Taguchi's concept of quality-Codes and standards-Documents-Contract and construction programming-Inspection procedures-Processes and products-Total QA / QC Programme and cost implication

Module II (14 hours)

Quality Assurance and Control -Objectives-Regularity agent-Owner, Design, Contract And Construction Oriented Objectives, Methods-Techniques and Needs Of QA/QC-Different Aspects of Quality-Appraisals, Factors Influencing Construction Quality-Critical, Major Failure Aspects And Failure Mode Analysis.

Standardization - Selection Of New Materials-Influence Of Drawings, Detailing And Specification Based On Codal Provisions.

Module III (12 hours)

Construction Accidents - Injury And Accidents-Definitions-Unsafe Act –Unsafe Condition-Causes, Investigations And Prevention Of Accidents, Hazards, Type Of Industrial Hazards-Nature, Causes And Control Measures, Hazard Identifications And Control Techniques - HAZOP , FMEA, FMECA. -Cost of Construction Injuries-Legal Implications

Safety Programmes - Introduction to the Concept of Safety- Need- Safety Provisions in the Factory Act-Laws related to the Industrial Safety-Measurement Of Safety Performance, Safety Audit, Problem Areas In Construction Safety-Elements of an Effective and Safety Programme-Job site Safety assessment- Safety Meetings-Safety Incentives

Module IV (14 hours)

Safety Organization –Safety Policy, Safety Record Keeping, Safety Culture-Safe Workers-Safety and First Line Supervisors-Safety and Middle Managers-Top Management Practices, Company Activities and Safety-Safety Personnel-Sub contractual obligation, Project Coordination and Safety Procedures

References:

1. James, J.O Brien, “*Construction Inspection Handbook - Quality Assurance and Quality Control*”, Van Nostrand, New York, 1989.

2. Kwaku A., Tenah and Jose M.Guevera, "*Fundamental of Construction Management and Organization* ", Prentice Hall of India, 1995.
3. Juran Frank, J.M. and Gryna, F.M. " *Quality planning and Analysis* ", Tata McGraw Hill, 1982.
4. Hutchins. G., "ISO 9000 ", Viva Books, NewDelhi, 1993.
5. Clarkson H. Oglesby, "*Productivity Improvement in Construction* ", McGraw Hill 1989.
6. John L.Ashford, " *The Management of Quality in Construction* ", E & F.N Spon, New York, 1989.
7. Steven McCabe, "*Quality Improvement Techniques in Construction* ", Addisson Wesley Longman Ltd., England, 1998.
8. Jimmy W.Hinze, "*Construction Safety* ", Prentice Hall Inc., 1997.
9. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, "*Construction Safety and Health Management* ", Prentice Hall Inc., 2001.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 104 Contract Laws and Regulations

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the various types of construction contracts and their legal aspects and provisions.

Module I (13 hours)

Construction contracts: Indian Contracts Act-Elements of Contracts-Types of contracts-Features-Suitability-Design of Contract Documents-International contract document-Standard contract Document-Law of Torts

Module II (13 hours)

Tenders: Prequalification-Bidding-Accepting-Evaluation of Tender from Technical, Contractual and commercial points of view-contract formation and interpretation-Potential contractual problems-World Bank Procedures and Guidelines

Module III (13 hours)

Arbitration-Comparison of Actions and Laws-Agreements, subject matter-Violations-Appointment of Arbitrators-Conditions of Arbitrations-Powers and duties of Arbitrator-Rules of Evidence-Enforcement of Award-costs

Module IV (15 hours)

Legal Requirements-Insurance and Bonding-Laws Governing Sale, Purchase and use of Urban and Rural land-Land Revenue codes- Tax Laws-Income Tax, Sales Tax, Excise and customs duties and their influence on construction costs-Local Government Laws for Approval

Labour Regulations-Social Security-Welfare Legislation-Laws relating to wages and Bonus, Labour Administration- Insurance and Safety Regulations-Workmen's Compensation Act.

References:

1. Gajaria G.T., "*Laws Relating to Building and Engineering Contracts in India*", M.M.Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze, "*Construction Contracts*", 2nd Edition, McGraw Hill, 2001.
3. Joseph T. Bockrath, "*Contracts and the Legal Environment for Engineers and Architects*", 6th Edition, McGraw Hill, 2000.
4. Richard Hudson Clough, Glenn A. Sears, "*Construction Contracting*", J. Wiley, 21-Mar-2005

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

ELECTIVE I

CEM10 105(A) Energy Conservation Techniques in Building Construction

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the design of energy efficient buildings which balances all aspects of energy, lighting, space conditioning and ventilation by providing a mix of passive solar design strategies and to learn the use of materials with low embodied energy.

Module I Energy (11 hours)

Fundamentals of Energy-Energy production systems-Heating, Ventilating and Air conditioning-Solar Energy and conservation-Energy Economic Analysis-Energy Conservation And Audits-Domestic Energy Consumption-Savings-Primary Energy use in Buildings-Residential-Commercial-Institutional And Public Buildings.

Module II Energy Conservation (12 hours)

Energy and resource conservation-Principles, Design of green buildings-rating systems-LEED Standards-Evaluation Tools for Building Energy-Embodied and Operating Energy-Peak demand-Comfort and Indoor Air Quality-Visual and Acoustical Quality-Energy Efficient Design Strategies-Contextual factors-Longevity and Process Assessment

Module III Energy Efficiency (15 hours)

Energy in Building Design-Energy Efficient and Environmental Friendly Building- Climate, Sun and solar radiation-Psychometrics-Passive Heating and Cooling Systems- Energy Audit-Types of Energy audit-Analysis of results-Energy flow diagram-Energy consumption/Unit production-Identification of wastage-Priority of conservative measures-Maintenance of Energy Management Programme

Module IV Energy Management (16 hours)

Energy Management of Electrical Equipment-Improvement of Power Factor-Management of Maximum Demand- Energy Savings in Pumps-Fans-Compressed Air Systems-Energy Savings in Lighting Systems-Air Conditioning Systems-Applications-Facility Operation And Maintenance-Facility Modifications-Energy Recovery Dehumidifier- Water Heat Recovery-Steam Plants and Distribution Systems- Energy Savings In Pumps-Fans-Compressed air systems- Applications

References:

1. Moore F., " *Environmental control systems* ", McGraw Hill, Inc., 1994.
2. Brown, G.Z, Sun, " *Wind and Light: Architectural design Strategies* ", John Wiley & Sons., 1985.
3. Cook, J, " *Award - Winning Passive Solar Design* ", McGraw Hill, 1984.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The

assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 105(B) Advanced Concrete Technology

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the various types of concrete and its mix design.

Module I (12 hours)

Cement- Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, transition Zone, Elastic Modulus, factors affecting strength and elasticity of concrete, Rheology of concrete in terms of Bingham's parameter.

Module II (13 hours)

Chemical Admixtures- Mechanism of chemical admixture, Plasticizers and super Plasticizers and their effect on concrete property in fresh and hardened state, Marsh Cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, and new generation superplasticiser.

Mineral Admixture- Fly ash, Silica fume, GGBS, and their effect on concrete property in fresh state and hardened state.

Module III (15 hours)

Mix Design - Factors affecting mix design, design of concrete mix by BIS method.

RMC Concrete - Manufacture, transporting, placing, precautions, Methods of concreting- Pumping, under water concreting, shotcrete, High volume fly ash concrete -concept, properties, typical mix

Self compacting concrete- Concept, materials, tests, properties, application and Typical mix.

Ferro cement - Materials, techniques of manufacture, properties and applications.

Module IV (14 hours)

Fiber reinforced concrete - Fibers types and properties, Behavior of FRC in compression, tension including pre-cracking stage and post-cracking stages, behavior in flexure and shear.

Light weight concrete- Materials properties and types. Typical light weight concrete mix, High Density Concrete, High Strength Concrete and High Performance Concrete-materials, properties and applications, typical mix.

References:

1. Neville, A.M., " *Properties of concrete* ", 4th edition, Longman, 1995.
2. Metha P.K. and Montreio P.J.M., " *Concrete Structure Properties and Materials* ", 2nd edition, Prentice Hall, 1998.
3. Mindaas and Young, " *Concrete* ", Prentice Hall, 1998.
4. M.S.Shetty, " *Concrete Technology - Theory and Practice* ", S.Chand and Company, New Delhi, 1992.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 105(C): Quantitative Techniques in Management

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the various quantitative methods applied to the elements of management.

Module I Operations Research (14 hours)

Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post- Optimality Analysis-Transportation and Assignment Problems.

Module II Production Management (13 hours)

Inventory control: EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control.

Module III Financial Management (13 hours)

Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow
Techniques-Capital Budgeting.

Module IV Decision Making & Risk Analysis (14 hours)

Decision Theory-Decision Rules-Decision making under conditions of certainty, risk and uncertainty-Decision trees-Utility Theory Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory application.

References:

1. Vohra, N.D. "*Quantitative Techniques in Management* ", Tata McGraw Hill Co., Ltd , New Delhi, 1990.
2. Seehroeder, R.G., "*Operations Management* ", McGraw Hill, USA, 1982.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., "*Quantitative Approaches to Management* ", McGraw Hill Book Co., 1988.
4. Frank Harrison, E., "*The Managerial Decision Making Process* ",Houghton Mifflin, 1995.
5. RL Varshney and KL Maheshwari , "*Managerial economics*", Sultan Chand, 1990.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 105(D): Maintenance and Rehabilitation of Buildings

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the damages, repair and rehabilitation of structures.

Module I (13 hours)

Durability: Life Expectancy of Different Types of Buildings –Influence of Environmental Elements Such as Heat, Moisture, Precipitation and Frost on Buildings- Design and Construction Errors, Corrosion Mechanism- Effect of Biological Agents like fungus, moss, plants, trees, algae, - Termite Control and Prevention - Chemical Attack on Building Materials and Components- - Aspects of Fire and Fire Prevention on Buildings- Impact of Pollution on Buildings.

Module II (13 hours)

Maintenance- Definitions, objectives , Phases of Maintenance, Repair and Rehabilitation- Common Defects In Buildings And Measures To Prevent And Control The Same- Building Failures – Causes And Effects- Cracks In Buildings -Preventive Measures o Various Aspects- Inspection, Assessment Procedure For Evaluating Damaged Structure -Causes of Deterioration - Testing Techniques- Non Destructive Testing Methods.

Module III (13 hours)

Materials- - Materials For Repair - Special Mortar And Concretes, Concrete Chemicals, Special Cements And High Grade Concrete – Expansive Cement, Polymer Concrete, Sulphur Infiltrated Concrete, Ferro Cement, Fiber Reinforced Concrete- Admixtures Of Latest Origin.

Techniques for Repair - Surface Repair – Material Selection – Surface Preparation - Rust Eliminators And Polymers Coating For Rebars During Repair – Repair Of Cracks In Concrete And Masonry-Methods Of Repair - Epoxy Injection, Mortar Repair For Cracks - Guniting And Shotcreting -Waterproofing Of Concrete Roofs.

Module IV (15 hours)

Strengthening Measures - Flexural Strengthening, Beam Shear Capacity Strengthening, Column Strengthening, Shoring, Under Pinning And Jacketing

Demolition Of Buildings – Introduction – Planning, Precautions And Protective Measures In Demolition Work-Sequence Of Operations- Demolition Of Structural Elements.

References:

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures ”, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, " *Repair of Concrete Structures* ", Blakie and Sons, UK, 1987.
3. A.R. Santhakumar, “Concrete Technology”, 2012 Oxford University Press ,2006
4. Edward D. Mills,” *Building Maintenance and Preservation: A Guide for Design and Management*”, Butterworth-Heinemann, 1996
5. Raikar, R.N., " *Learning from failures - Deficiencies in Design* ", Construction and Service - R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
6. CPWD “*Handbook on Repairs and Rehabilitation of RCC Buildings*”, 2002

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students’ right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 106(P): Advanced CAD Lab

Hours per week 2

List of Experiments

1. Quantity takeoff, Preparation and delivery of the bid or proposal of an engineering construction project.
2. Design of a simple equipment information system for a construction project.
3. Scheduling of a small construction project using Primavera scheduling systems including reports and tracking.
4. Scheduling of a small construction project using tools like MS project scheduling systems including reports and tracking.

List of Equipments / Softwares / Tools Requirements

1. MS OFFICE
2. MS PROJECT
3. PRIMAVERA
4. REVIT
5. AutoCAD 2012
6. PERT MASTER

Internal Continuous Assessment: 100 Marks

Regularity – 30%
Record – 20%
Test and Viva – 50%

CEM10 107(P): SEMINAR I

Hours per week 2

Objectives: This course is intended for:

- *Increasing the breadth of knowledge*
- *Enhancing the ability of self study*
- *Improving presentation and communication skills*
- *Augmenting the skill of Technical Report Writing.*

Each student is required to choose a topic of their interest from Construction Engineering & Management or related topics from outside the syllabus and present a topic for about 45 minutes. A Committee consisting of at least three faculty members shall assess the presentation. Internal Continuous Assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

Internal continuous assessment: 100 marks

Semester 2

CEM10 201 Construction Planning, Scheduling and Control

Hours per week: Lecture-3 and Tutorial-1

Objective: To study and understand the concept of planning, scheduling and the techniques necessary for construction project

Module I (14 hours)

Construction Planning - Basic Concepts in the Development of Construction Plans-Choice of Technology and Construction Method- Defining Work Tasks-Definition-Defining Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

Module II (17 hours)

Scheduling Procedures And Techniques - Relevance Of Construction Schedules-The Critical Path Method-Activity Float And Schedules-Critical Path Scheduling For Activity-On-Node And With Leads, Lags And Windows-Resource Oriented Scheduling-Scheduling With Resource Constraints And Precedence-Use Of Advanced Scheduling Techniques-Scheduling With Uncertain Durations-Calculations For Monte Carlo Schedule Simulations-Crashing And Time/Cost Tradeoffs

Module III (12 hours)

Cost Control Monitoring And Accounting- The Cost Control Problem-The Project Budget-Forecasting for Activity- Cost Control Financial Accounting Systems and Cost Accounts-Control of Project Cash Flows-Schedule Control-Schedule and Budget Updates-Relating Cost and Schedule Information.

Module IV (11 hours)

Organization and Use Of Project Information- Types of project information-Accuracy and Use of Information-Computerized organization and use of Information-Organizing information in databases-Relational Model Of Data Bases-Other conceptual Models of Databases-Centralized databases Management systems-Databases and application programs-Information transfer and Flow.

References:

1. Chitkara, K.K. " *Construction Project Management Planning* ", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenngam, " *Project planning, Scheduling and Control in Construction: An Encyclopedia of Terms and Applications* ", Wiley, New York, 1995.
3. Chris Hendrickson and Tung Au, " *Project Management for Construction – Fundamentals Concepts for Owners* ", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Moder.J., C.Phillips and Davis, " *Project Management with CPM* ", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.
5. Willis., E.M., " *Scheduling Construction projects* ", John Wiley and Sons 1986.
6. Halpin,D.W., " *Financial and cost concepts for construction Management* ", John Wiley and Sons, New

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

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Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 202 Construction Personnel Management

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the various aspects of manpower management in construction

Module I Manpower Planning (14 hours)

Manpower Planning, Organizing, Staffing, directing and Controlling-Personnel Principles-case studies.

Module II Organization (14 hours)

Organization-Span of control-Organization charts-Staffing plan-Development and Operation of Human resources- Managerial Staffing-Recruitment-Selection-Placement, Training and Development.

Module III Human Behaviour (14 hours)

Introduction to the Field Of Management-basic individual psychology-motivation-job design and performance management-Managing groups at work-self managing work teams-Inter group behavior and conflict in organizations-Leadership-Behavioral aspects of decision-making; and communication for people management.

Module IV Management and Development Methods (12 hours)

Compensation-Wages and Salary, Employee Benefits, employee appraisal and assessment-Employee services- Safety and Health-Discipline and Discharge-Special human resource problems, Performance appraisal-Employee Hand Book And Personnel Manual-Job descriptions and organization structure and Human relations-Productivity of Human resources.

References:

1. Carleton Counter II and Jill Justice Coulter, "*The Complete Standard Hand Book of Construction Personnel Management* ", Prentice Hall, Inc., New Jersey, 1989.
2. Memoria, C.B., "*Personnel Management* ", Himalaya Publishing Co., 1992.
3. Josy.J Familaro, "*Handbook of Human Resources Administration* ", McGraw Hill International Edition, 1987.
4. Justin Gooderl Longenecker, Charles D. Pringle, "*Management* " C.E. Merrill, 1981.
5. R.S.Dwivedi, "*Human Relations and Organizational Behaviour* ", B.H - 1987.
6. Shamil Naoum, "*People and Organizational Management in Construction*", Thomas Telford, 2001
7. Stephen Bach & Keith Sissons, "*A Comprehensive Guide to Theory and Practice*", John Wiley & Sons, 2000.
8. Andrew Dainty, Martin Loosemore, "*Human Resource Management in Construction Projects*", Routledge, 2012.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 203 Construction Economics and Finance Management

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the role and methods of economics and finance concepts applied to construction Business.

Module I (12 hours)

Economics- Role of Civil Engineering in Industrial Development-Advances in Civil Engineering and engineering economics- Support matters of Economy as related top Engineering-Market demand and supply-Choice of technology- Quality control and Quality Production-Audit in economic law of returns governing production

Module II (13 hours)

Construction of economics- Construction development in housing, Transport and other infrastructures-Economics of Ecology, environment, energy resources-Local material selection-Form and Functional designs-Construction workers-Urban problems-Poverty-Migration-Unemployment-pollution.

Module III (14 hours)

Financing- The need for financial management-Types of financing-Short term borrowing-Long term borrowing-Leasing - Equity financing-Internal generation of funds-External commercial borrowings-Assistance from Government Budgeting support and International finance corporations-Analysis of financial statements-Balance sheet-Profit and loss account-Cash flow and fund flow analysis-Ratio analysis-Investment and financing decision-Financial control-Job control and Centralized management

Module IV (15 hours)

Accounting Method- General Overview-Cash basis of an accounting-Accrual basis of accounting-Percentage completion method- Completed contract method-Accounting for Tax reporting purposes and financial reporting purposes.

Lending to Contractors- Loans to Contractors-Interim Construction Financing-Security and Risk Aspects

References:

1. Prasanna Chandra, "*Projects - Planning Analysis Selection Implementation & Review* ", Fourth Edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 1995.
2. Kwaku A., Tenah and Jose M. Guevera, "*Fundamental of Construction Management and Organization* ", Prentice Hall of India, 1995 .
3. Halpin, D.W., "*Financial and cost concepts for construction Management* ", John Wiley and Sons, New York, 1985.
4. Madura J. and Veit, E.T., "*Introduction to Financial Management* ", WestPublishing Co., 1988.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The

assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

ELECTIVE II

CEM10 204(A) Computer Applications in Construction Engineering and Planning

Objective: This course gives an exposure to students to the various sophisticated Spread sheets programs, Estimation Software and other package programs.

Module I Software Applications (14 hours)

Introduction To BIM Software Application To Enhance Efficiency During And Post Construction Phases And Facility Management. Applications like Determination of Quantities of Items and Material Inventory, To Build a Building Virtually Prior to Building It Physically, Work Out Problems, and Simulate And Analyze Potential Impacts, Anticipation And Ease Of Project Delivery, The Overall Safety Of The Project.

Module II (13 hours)

Optimization Techniques: Linear, Dynamic and Integer Programming-Branch and Bound Techniques-Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems - Deterministic and Probabilistic Inventory Models-Software Development

Module III (14 hours)

Scheduling Applications-Introduction to Software like Primavera-P6/MS Project/Sure trak-For schedule development and tracking of it; Prolog-Data Management-RFI's [Request for Information], Submittals-Product Data, Punch list etc.; JDE [JD Edwards]-Financial Management-For use of tracking and developing the cost reports and issuing the change orders.

Module IV (13 hours)

Scheduling Applications: PERT and CPM-Software Development- Navisworks-In this software 3D Auto CAD/Revit model can be imported with a project schedule to review the progress of the Project

References:

1. Bily E. Gillet., "*Introduction to Operation Research*" - A Computer Oriented Algorithmic Approach, Tata McGraw Hill, 1990.
2. Paulson, B.R., "*Computer Applications in Construction* ", McGraw Hill, 1995.
3. Feigenbaum., L., "*Construction Scheduling With Primavera Project Planner* ", Prentice Hall Inc., 1999.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 204(B) Management Information Systems

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the concepts of information systems and their general applications

Module I (13 hours)

Introduction- Establishing the frame work-Business Models-Information System Architecture-Evolution of Information Systems.

Module II System Development (12 hours)

System Development Life cycle-Structured Methodologies-Designing computer based Methods, Procedures, and Control-Designing structured programs.

Module III Information Systems (14 hours)

Integrated construction Management Information System-Project Management Information System-Functional Areas, Finance, Marketing, Production, Personnel-Levels, DSS, EIS, ES-Comparison, Concepts and Knowledge Representation-Managing International Information System.

Module IV (15 hours)

Implementation and Control -Control-Testing Security-Coding Techniques-Detection of Error-Validating-Cost Benefit Analysis-Assessing the Value and Risk of Information System.

System audit -Software Engineering Qualities-Design-Production, Service, Software Specification, Software metrics, Software Quality assurance-Systems Methodology-Objectives-Time and Logic, Knowledge and Human Dimension- Software Life Cycle Models-Verification and Validation.

References:

1. Kenneth C Laudon and Jane Price Laudon, "*Management Information Systems - Organization and Technology* ", Prentice Hall, 1996.
2. Gordon B. Davis, " *Management Information System: Conceptual Foundations* ", *Structure and Development*, McGraw Hill, 1974.
3. Joyce J Elam, " *Case Series for Management Information Systems* ", Simon and Schuster, Custom Publishing, 1996.
4. Ralph H Sprague and Huge J Watson, " *Decision Support for managers* ", Prentice Hall, 1996.
5. Michael W Evans and John J Marciniak, " *Software Quality assurance and Management* ", John Wiley and Sons , 1987
6. Card and Glass, "*Measuring Software Design Quality* ", Prentice Hall, 1990.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 204 (C): Eco-friendly Constructions

Hours per week: Lecture-4 and Tutorial-0

Objectives: To study and understand the function of materials used for constructing eco friendly constructions and generate substantial cost savings

Module I Eco-friendly Planning (13 hours)

Energy Efficient Shelters, Housing Options Today, Site Planning and Use of On-Site Resources, Smaller Houses that Utilize Space and Materials More Efficiently, Working With Nature, Better Window Planning, Balancing Energy and Aesthetic Needs.

Module I Eco-friendly Materials (14 hours)

Construction materials –locally available building materials- Soil, Fly ash, Ferrocement, Lime, Fibres, Stone Dust, Red mud, Gypsum, Alternate Wood, Polymer-ADOBE, Cob Rammed Earth, Light Clay, Straw-Bale, Bamboo, Agro-Industrial Waste, Innovative Materials Developed by CBRI, SERC, Structural Properties Of Alternate Building Materials, Earthen Finishes , Earth Plasters, Earth Floors.

Module III Cost Effective Construction Techniques (14 hours)

Construction Techniques-Innovative Techniques developed by CBRI, SERC for foundation, superstructure, roofing, pre-fabricated construction techniques, advantage of pre-fabrication areas where pre-fabrication can be introduced, modular contained earth, earth bag construction

Module IV Cost Effective Construction Equipments (13 hours)

Equipments-Brick moulding machine, Stabilised soil block making machine and plants for the manufacturing of concrete blocks, M.C.R. tile making machine, Ferrocement wall panel & Roofing channel making machine, R.C.C. Chalkhat making machine.

References:

1. Givoni, “*Man, Climate, Architecture*”, Van Nostrand, New York, 1976.
2. Charles J. Kibert, *Sustainable Construction: Green Building Design and Delivery*, John Wiley & Sons, 2005
3. Lynne Elizabeth, Cassandra Adams “*Alternative Construction : Contemporary Natural Building Methods*”, Softcover, Wiley & Sons Australia, Limited, John, 2005
4. Eugene Eccle- “*Low Cost, Energy efficient shelter for owner & builder*”, Rodale Press, 1976

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 204 (D): Advanced Construction Techniques

Hours per week: Lecture-3 and Tutorial-1

Objective: To study and understand the latest construction techniques applied to Engineering Construction

Module I (15 hours)

Sub Structure Construction -Box jacking -Pipe Jacking-Under Water Construction of diaphragm walls and Basement-Tunneling Techniques- Piling Techniques-Driving Well And Caisson-Sinking Cofferdam-Cable Anchoring And Grouting-Driving Diaphragm Walls, Sheet Piles-Laying Operations For Built Up Offshore System-Shoring For Deep Cutting-Large Reservoir Construction with membranes and Earth system-well points-Dewatering and stand by Plant equipment for underground open excavation

Module II (16 hours)

Super Structure Construction- Vacuum dewatering of concrete flooring-Concrete paving technology-Techniques of construction for continuous concreting operation in Tall buildings of various shapes and Varying sections-Launching Techniques-Suspended formwork-erection techniques of tall structures, Large span structures-Launching techniques for heavy decks- in-situ pre-stressing in high rise structures, aerial transporting ,handling, erecting light weight components on tall structures-erection of lattice towers and rigging of transmission line structures

Module III (12 hours)

Construction Sequences- in cooling towers, Silos Chimney, Sky scrapers, bow string bridges, cable stayed bridges-Launching and pushing of box decks- support structure for heavy Equipment and conveyor and machinery in heavy industries-erection of articulated structures, braced domes and space decks.

Module IV (11 hours)

Repair Construction-Mud Jacking Grout through Slab Foundation-Micro Piling for Strengthening Floor and Shallow Profile-Pipeline Laying, Protecting Sheet Piles, Sub Grade Water Proofing, Underpinning Advanced Techniques And Sequence In Demolition And Dismantling.

References:

1. Robertwade Brown, " *Practical foundation engineering hand book* ", McGraw Hill Publications, 1995.
2. Patrick Powers. J., " *Construction Dewatering: New Methods and Applications* ", John Wiley and Sons, 1992.
3. Jerry Irvine, " *Advanced Construction Techniques* ", California Rocketry, 1984).
4. National Building Code of India, Part-IV and VII – 2006.
5. Rai Mohan and Jai Singh.M.P," *Advances in Building Materials and Construction*" CBRI Roorkee
6. SP-23 (S&T) – Hand Book on concrete Mixes based on Indian standards

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The

assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

ELECTIVE III

CEM10 205(A) Shoring, Scaffolding and Formwork

Hours per week: Lecture-3 and Tutorial-1

Objective: To study and understand the various types of scaffolding, formworks, shoring methods and techniques

Module I (13 hours)

Planning- Overall Planning -Detailed planning - Standard units - Corner units - Schedule - Planning at Tender stage - Development of basic system - Planning for maximum reuse - Planning examples - Site layout plan-Crane arrangements -Recheck plan details - Planning for safety-Transporting plant -Wales and ties - Vertical transportable form work.

Module II (13 hours)

Materials, Accessories and Proprietary Products - Lumber - Types - Finish - Sheathing ratio - Working stresses -Repetitive member stress - Plywood -Types and grades -Textured surfaces and strength - Reconstituted wood -Steel -Aluminum -Form lining materials

Design considerations- Live loads and Wind pressure -Concrete pressure on form work- Concrete density -Height of discharge -Temperature -Rate of Placing -Consistency of concrete - Vibration - Hydrostatic pressure and pressure distribution -Examples -Adjustment for non-standard conditions- Basic simplification - Beam forms -Slab forms- Column forms -Wall forms -Allowable stresses - Check for deflection, bending and lateral stability - Examples.

Module III (14 hours)

Building And Erecting The Framework- Location of job mill -Storage -Equipment-Form for Wall footings -Column footings -Slab on grade and paving work -Highway and Airport paving - External vibration -Prefabricated panel systems - Giant forms -Curved wall forms -Erections Practices -Column heads-Beam or girder forms - Suspended forms- Concrete Joint construction- Flying system forms. **Causes of Failures** -Case studies- Finish of exposed concrete -Design deficiencies -Safety factors -Stripping sequence - Reshore installation -Advantages of reshoring.

Module IV (14 hours)

Formwork Design - Shell forms -Design considerations -Loads -Building forms -Strength requirements -Tunnel forming components - Curb and gutter forms - Invert forms -Arch forms - Concrete placement methods - Slip forms-Principles -Types -Advantages -Functions of various components-Planning -Safety in slip forms -Special structures built with slip form technique - Codal provisions -Types of scaffolds -Putlog and Independent scaffold -Single pole scaffolds - Fixing ties- Spacing of ties - bracing -knots safety net -General safety requirements- Shuttering for Precast members and continuous casting forms.

References:

1. Robert L.Peurifoy and Garold D.Oberiender, " *Formwork For concrete Structures* ",McGraw-Hill, 1996.

2. Hurd, M.K., “*Formwork for Concrete*”, Special Publication No. 4 Sixth Edition, American Concrete Institute, Detroit, 1995.
3. Michael P. Hurst, “*Formwork*”, Construction Press, London and New York, 1997.
4. Austin, C.K., " *Formwork for concrete* ", Cleaver - Hume Press Ltd., London, 1996.
5. Tudor Dinescu and Constantin Radulescu, “*Slipform Techniques*”, Abacus Press, Turn Bridge Wells, Kent, 1992.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students’ right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 205 B: System Integration in Construction

Hours per week: Lecture-3 and Tutorial-1

Objective: To study and understand the construction system integration.

Module I (15 hours)

Structural- Structural system, Systems for enclosing buildings, Functional aesthetic system, Materials selection and Specification. Environmental-Qualities of enclosure necessary to maintain a specified level of interior environmental quality-Weather Resistance-Thermal infiltration-Acoustic control-Transmission reduction-Air quality-Illumination-Relevant Systems integration with structural systems

Module II (13 hours)

Mechanical & Communication systems -Elevators, Escalators, Conveyors, Security Systems In High Rise Building Complexes, Public Buildings, Parking Lots And Complex Structures Like Hospitals, Public Transport Terminals . Design parameters for Determining the Loads & Requirement, Operation And Maintenance Of These Services.

Module III (13 hours)

Maintenance-Component Longevity in terms of operation performance and resistance to deleterious forces-Planning systems for least maintenance-Feasibility for replacement of damaged components -equal life elemental design- Maintenance free exposed and finished surfaces.

Module IV (14 hours)

Intelligent Buildings & Building Management System (BMS)-Concept-Purpose-Control Technologies- Automation Of All The Services And Equipment -Building Management Systems (BMS) -Commercial, Industrial, Institutional And Domestic Buildings-Energy Management Systems And Building controls.

References:

1. S. Don Swenson., *HVAC Heating, Ventilating, and Air Conditioning* ,2004
2. William T.Mayer, " *Energy Economics and Build Design* ", McGraw Hill Book Co., 1983.
3. Peter R.Smith and Warren G.Jullian, " *Building services* ", Applied Science Publishers Ltd.,London.1976
4. A.J.Elder and Martiz Vinden Barg, " *Handbook of Buildings and Enclosure* ", Mc Graw-Hill Book Co., 1983.
5. David Fletcher, *Intelligent Buildings: Design Management and Operation*, The Institution of Structural Engineers,2004
6. Derek Clements-Croome, *Intelligent Buildings: Design, Management And Operation*, Thomas Telford, 2004

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 205(C) Reuse & Recycle Technology

Hours per week: Lecture-3 and Tutorial-1

Objective: To promote innovative technologies to reduce waste, recycle and reuse.

Module I (11 hours)

Waste as a Resource- Resource Economics, Disposable Materials, Recovery, Recycling, Collection, Processing, Governmental Role in Waste Management, Potential for Reuse.

Waste Analysis: Sampling, Composition, Categorization, Determination of Waste Properties, Ash and Fineness Analysis, Energy Content.

Module II (15 hours)

System Design: Design of Recycling Systems, Collection System, Process Train Design and Complexity, Product Design of Recycling, Conveyance, Transport Safety, Efficiency of Operation Systems.

Energy Recovery: Combustion, Energy Losses, Energy Recovery Analysis, Emission Control, Residue Control, In-plant Operations, Refuse Derived Fuel-cogeneration and tri generation concepts.

Module III (14 hours)

Water Reuse: Direct and Indirect Reuse, Intentional Reuse, Groundwater Recharge, Case studies of Water Reuse, Close Cycle and Open Cycle Reuse, Recreational Reuse.

Reuse of Industrial Effluents: Urban Effluent Reuse for Agriculture in Arid and Semiarid Zones, Uses of in Pisciculture, Groundwater Recharge using treated Domestic wastewater.

Module IV (14 hours)

Metals Recovery: Ferrous Metals, Properties, Principles of Magnetic Field-ferrous Material Interactions, Magnetic Separation Equipment, Non-ferrous Metal Separation, Eddy-Current Separation – Theory and Types, Extraction of Material from a Bed.

Health Aspects of Water Reuse: Guidelines for Evaluating Recreational Water Reuse, Resource Conservation and Recovery Act.

References:

- 1 Takashi Asano, *Water Reuse: Issues, Technologies, and Applications*, , McGraw-Hill Prof Med/Tech, 2007
- 2 Mackenzie Davis, and Susan Masten, "*Principles of Environmental Engineering & Science*", McGraw Hill ,2 nd edition, 2008.
- 3 Henry, J. G. and G. W. Heinke, "*Environmental Science and Engineering*", 2nd edition, Prentice Hall, Inc., Upper Saddle River, NJ, 1996.
- 4 Kiely, G, "*Environmental Engineering*", Irwin/McGraw-Hill Book Co., Singapore, 1999
- 5 Vogler, Jon, *Work from Waste – Recycling Wastes to Create Employment*, Intermediate Technology Publications, 1981
- 6 McHarry, Jan, *Reuse Repair Recycle*, Gaia Books Ltd. 1993

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 205(D) Smart Materials and Smart Structures

Hours per week: Lecture-3 and Tutorial-1

Objective: This course is designed to give an insight into the latest developments regarding smart materials and their use in structures.

Module I Introduction (11 hours)

Introduction to Smart Materials and Structures – Instrumented Structures Functions And Response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

Module II Sensors (15 hours)

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain, measurement – Inductively Read Transducers – The LVDT – Fiber Optic Techniques. Chemical and Bio-Chemical sensing in Structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

Module III Measuring Techniques (14 hours)

Measuring Techniques - Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

Module IV Actuators (14 hours)

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electrorheological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials.

References:

1. Brain Culshaw – *Smart Structure and Materials* Artech House – Borton. London-1996.
2. Srinivasan ,A.V and Michael McFarland . D, “*Smart Structures – Analysis and Design* , Cambridge University Press, 2001.
3. L. S. Srinath , *Experimental Stress Analysis* , Tata McGraw-Hill, 1998.
4. J. W. Dally & W. F. Riley , *Experimental Stress Analysis* , Tata McGraw-Hill, 1998.
5. Mukesh V. Gandhi, Brian S. Thompson, *Smart Materials and Structures*, Springer,May-1992

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students’ right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 206(P) Mini Project

Hours per week 2

The project work can be a design project, experimental project or field surveying on any of the topics of Civil Engineering interest or survey camp, industrial or construction site training. The assessment of all the mini projects should be done by a Committee consisting of three or four faculty members specialized in the various fields of civil engineering. The students will present their project work before the Committee. Each group will prepare the project report and submit to the Department through the guide. The head of the department will certify the copies and keep in the Departmental Library.

Internal continuous assessment: 100 marks

CEM10 207(P) SEMINAR II

Hours per week 2

Objectives: This course is intended for:

- *Increasing the breadth of knowledge*
- *Enhancing the ability of self study*
- *Improving presentation and communication skills*
- *Augmenting the skill of Technical Report Writing.*

Each student is required to choose a topic of their interest from Construction Engineering & Management or related topics from outside the syllabus and present a topic for about 45 minutes. A committee consisting of at least three faculty members shall assess the presentation. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

Internal continuous assessment: 100 marks

ELECTIVE IV

CEM10 301(A) Disaster Management

Hours per week: Lecture-3 and Tutorial-1

Objective: To define and describe disaster, hazard, emergency, vulnerability, and risk and the importance of disaster management to handle the situation.

Module I (11 hours)

Objectives-Overview of Disaster Management – Distinguishing between an emergency and a disaster situation. Disaster Management Cycle – Phase I: Mitigation, and strategies; hazard identification and vulnerability analysis. Disaster Mitigation and Infrastructure, impact of disasters on development programmes, vulnerabilities caused by development, developing a draft country-level disaster and development policy

Module II (15 hours)

Phases-Disaster Management Cycle – Phase II: Preparedness, Disaster Risk Reduction(DRR), Emergency Operation Plan (EOP), Mainstreaming Child Protection and Gender in Emergency Planning, Assessment, Disaster Management Cycle – Phases III and IV: Response and recovery, Response aims, Response Activities, Modern and traditional responses to disasters, Disaster Recovery, and Plan , Disasters as opportunities for development initiatives

Module III (14 hours)

Disaster Community-Community-based Initiatives in Disaster management, need for Community-Based Approach, categories of involved organizations: Government, Non-government organizations (NGOs), Regional And International Organizations, Panchayaths, Community Workers, National And Local Disaster Managers, Policy Makers, Grass-Roots Workers, Methods Of Dissemination Of Information, Community-Based Action Plan, Advantages/Disadvantages Of The Community-Based Approach

Module IV (14 hours)

Disaster Planning-Disaster Response Personnel and duties, Community Mitigation Goals, Pre-Disaster Mitigation Plan, Personnel Training, Volunteer Assistance, School-based Programmes, Hazardous Materials, Ways of storing and safely handling hazardous materials, Coping with Exposure to Hazardous Materials

References:

1. Ayaz., *Disaster Management: Through the New Millennium.* , Anmol Publications. (2009)
2. Dave, P. K.. *Emergency Medical Services and Disaster Management: A Holistic Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2009
3. Narayan, B. ,*Disaster Management*, New Delhi: A.P.H. Publishing Corporation ,2009
4. Kumar, N.. *Disaster Management*. New Delhi: Alfa Publications. ,2009
5. Ghosh, G. K., *Disaster Management*. New Delhi: A.P.H Publishing Corporation. ,2008
6. Goel, S. L., *Disaster Management*. New Delhi: Deep & Deep Publication Pvt. Ltd. ,2008
7. Singh, R. B. ,*Disaster Management*. New Delhi: Rawat Publications., 2008.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 301(B) Materials Management

Hours per week: Lecture-3 and Tutorial-1

Objective: To define and describe the effective purchase, utilization and storage of materials

Module I (11 hours)

Material Classification- Organizing for materials management – basis for forming organizations – conventional and modern approaches to organizing materials management. Materials identification – classifying of materials – codification of materials – standardization – simplification and variety reduction of materials

Module II (15 hours)

Material Purchasing – Planning Purchasing Materials – Norms Of Vendor Rating – Cei Methodology – Material Selection And Development – Purchasing Procedures And Methods – Legal Aspects – Insurance Of Materials – Supply Management – Sources Of Supply – Out Sourcing

Material Management- Procurement Organization - Procurement Planning - Functions Of Material Management - Inventory Control.

Module III (14 hours)

Storing of Materials -Management of stores – location – different types of stores – methods of storing – safety and security of materials – stores equipment – materials handling equipment – factors affecting materials handling

Module IV (14 hours)

Scrap & Obsolete Materials-Management of surplus obsolete and scrap materials – reasons for accumulation of surplus obsolete and scrap materials – methods of disposal – regulations and procedures

References:

1. A. K. Datta, *Materials Management: Procedures, Text and Cases*, PHI Learning Pvt. Ltd., 2004.
2. Arnold, *Introduction To Materials Management*, Pearson Education India, 2009
3. **Richard J. Tersine** ,*Principles Of Inventory And Materials ,Management*, Prentice Hall, 1994
4. Richard J. Tersine, *Modern Materials Management*, John Hardin Campbell - 1977
5. P. Gopalakrishnan, *Handbook of Materials Management*, PHI Learning Pvt. Ltd. 2004

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 301(C) GIS in Construction Engineering and Management

Hours per week: Lecture-3 and Tutorial-1

Objective: To introduce the elements of GIS as applied to Construction Management and achieve an awareness on application techniques

Module I (11 Hours)

Mapping-GIS - Definition - Components of GIS -Maps - Definition - Types of Maps - Characteristics of Maps - Map Projections -- Hardware, Software and Organizational Context - GIS software

Module II (14 hours)

Data Types - Spatial and Non-Spatial - Spatial Data - Points, Lines and areas- Non-spatial data - Nominal, Ordinal, Interval and Ratio - Digitizer - Scanner - Editing and Cleaning - Geo reference data

Module III (15 Hours)

Data Structure-Raster and Vector Data Structure - Raster data storage - Run length, Chain and Block Coding - Vector Data Storage - Topology - Topological Models - Arc Node Structure - Surface Data - DEM - Grid DEM and TIN structure- Applications of DEM

Module IV (14 Hours)

Data Measurement-Reclassification - Measurement - Buffering - Overlaying - SQL for Queries - Neighborhood and zonal operations - Data Quality - Components of data quality - Sources of errors in GIS - Meta data Output - Maps, Graphs, Charts, Plots, Reports - Printers - Plotters - Fields of application - Natural Resource Management, construction management-Parcel based, AM/FM applications examples - Case study

References

1. Burrough P.A., *Principles of GIS for Land Resources Assessment*, Oxford Publication, 1998
2. Robert Laurini and Derek Thompson, *Fundamentals of Spatial Information Systems*, Academic Press, 1996
3. Anji Reddy, *Remote Sensing and Geographical Information Systems*, BS Publications 2001
4. Srinivas M.G. (Edited by), *Remote Sensing Applications*, Narosa Publishing House, 2001
5. Rhind, D., *Understanding of GIS, The ARC / INFO Method*, ESRI Press. 1990

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 301(D) Construction Project Management

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the elements of construction project management consisting of owners' perspective, organization, design and construction procedures, resource utilization and cost estimation.

Module I (13 hours)

Project-Concept of a Project - Characteristic features - Project Life cycle - Phases - Project Management - tools and techniques for project management - role of project managers.

Development of Project Plan And Objectives - Programming - Scheduling - Project Organization - Organization And Project Team - Role Of Communication In Project Management - Controlling Systems.

Module II (14 hours)

Working Systems - Characteristics - Class Of Systems - Design Of Systems - Work Break Down System (WBS) - Project Execution Plan - Project Procedure Manual -Sub Systems Of Project Management- Monitoring Of Projects- Networks - Monitoring Contracts

Module III (13 hours)

Stages of Project-Project direction - Direction During Production Stage - Value Engineering Review - Stages -Directives - Project Coordination - Procedure - Interface Management - Project Control -Scope For Progress Control - Overall Project Progress Control - Stages - Methods.

Module IV (14 hours)

Labour and Equipment Utilization-Labour Productivity-Factors Affecting Job-Site Productivity-Labor Relations in construction-Problems in collective bargaining-Construction Equipment-Choice of Equipment and Standard production Rates-Construction Processes Queues and Resource Bottlenecks

Reference Books

1. Prasanna Chandra " *Project Planning, Analysis, Selection, Implementation and review*" Tata Mcgraw Hill ,1999
2. Chitkara, K.K, *Construction Project Management: Planning Scheduling and control*, Tata McGraw-Hill Publishing Company, New Delhi- 1998
3. Frederick E. Gould, *Construction Project Management*, Went worth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000
4. Choudhury, S *Project Management*, Tata McGraw-Hill Publishing company New Delhi 1988
5. Sengutha, B., Guha, H., " *Construction Management and Planning* ", TataMcGraw Hill, 2001

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

ELECTIVE V

CEM10 302(A) Building Services

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the elements of building services like water supply, sanitation, electrical installations ,air conditioning and fire safety

Module I (13 hours)

Water Supply & Sewage System-Water quality, Purification and treatment- water supply systems-distribution systems in small towns -types of pipes used- laying jointing, testing-testing for water tightness plumbing system for building-internal supply in buildings- municipal bye laws and regulations - Rain Water Harvesting - Sanitation in buildings- -pipe systems- storm water drainage from buildings -septic and sewage treatment plant - collection, conveyance and disposal of town refuse systems.

Module II (14 hours)

Electrical System-Types of wires , wiring systems and their choice -planning electrical wiring for building -main and distribution boards -transformers and switch gears -modern theory of light and colour -synthesis of light -luminous flux -candela- lighting design-design for modern lighting.

Module III (13 hours)

Ventilation- Ventilation and its importance-natural and artificial systems-Window type and packaged air-conditioners-chilled water plant -fan coil systems-water piping -cooling load -air conditioning systems for different types of buildings -protection against fire to be caused by A.C. systems.

Module IV (14 hours)

Safety Against fire in buildings- Safety-Ability of systems to protect fire-Preventive systems-Fire escape system design-Planning for pollution free construction environmental-Hazard free Construction execution safety regulations-NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems-heat and smoke detectors-dry and wet risers-Automatic sprinklers - Capacity determination of OHT and UGT for firefighting needs.

References:

1. E.R.Ambrose, "*Heat Pumps and Electric Heating*", John and Wiley and Sons, Inc., New York, 1968.
2. *Handbook for Building Engineers in Metric systems*, NBC, New Delhi, 1968.
3. William T. Mayer, *Energy Economics and Build Design*, McGraw-Hill Book, Company, 1983..
4. William H.Seaverns and Julian R.Fellows, "*Air-conditioning and Refrigeration*", John Wiley and Sons, London, 1988.
5. A.F.C. Sherratt, "*Air-conditioning and Energy Conservation*", The Architectural Press, London, 1980.
6. E.C. Butcher and A.C. Parnell, *Designing for Fire Safety*, John Wiley and Sons, 1993.

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The

assessment details are to be announced to students' right at the beginning of the semester by the teacher.

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End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 302(B) Resource Management and Control in Construction

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the resources required for construction like material, equipment, labour, time and comprehend the effective management of the same towards fruitful completion of the project.

Module I (13 Hours)

Resource Planning- Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control- Types of resources, manpower, Equipment Material, Money, Time

Systems approach in resource management, Characteristics of resources- Resources Utilization, measurement of actual resources required-Tools for measurement of resources

Module II (14 Hours)

Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution.

Equipment: Planning and Selecting By Optimistic Choice With Respect To Cost, Time Source and handling

Labour: Labor, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour

Module III (14 Hours)

Personnel Management-Personnel time management and planning- Managing time on the project- forecasting the future, Critical path measuring the changes and their effects.

Cost control- Cash flow and cost control, objectives of cost, time and quality.

Module IV (13 Hours)

Cost Analysis-Time-cost trade off Computer application in resource leveling- examples resource list, resource allocation graph, Resource loading- Cumulative cost ETC -Value Management.

References

1. Andrew, D. Szilagg, Hand Book of Engineering Management, 1982.
2. A.K.Jain ,“*Construction Management & Machinery*”,Standard Publisers Distributors,2010.
3. Glenn, A. Sea's and Reichard, H Clough, “*Construction Project Management*”,John Wiley and Sons, Inc, 1979
4. Harvey, A. Levine, “*Project Management using Micro Computers*”, Obsome McGraw Hill C.A. Publishing Co., Inc. 1988
5. James, A., Adrain, “*Quantitative Methods In Construction Management*”, American Elsevier Publishing Co., Inc., 1973.
6. Frederick E Gould, “*Managing the Construction Process-Estimating, Scheduling & Project Control*”,Dorling Kindersely India Pvt. Ltd.,2012

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The

assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 302(C) Pavement Construction Practice

Hours per week: Lecture-3 and Tutorial-1

Objective: To study the elements of construction of bituminous pavement consisting of materials, properties, construction procedures, machineries and latest advancement in pavement design.

Module I (12 Hours)

Construction Practice- Base courses – Bituminous macadam – Dense bituminous macadam – bituminous concrete – Semi Dense Bituminous Concrete – Construction methods – Marshall method of mix design for dense bituminous courses – Surface courses – Surface dressing, Premix carpet, Mix seal surfacing – Mastic asphalt - Construction methods – Quality Control measures – Sampling and analysis of bituminous binders and mixtures.

Module II (15 Hours)

Machineries: Road making machineries – Road formation, bituminous constructions, road surface evaluation.

Latest Advancements: Methods to improve bitumen quality – Rheological and chemical additives – Polymer modified bitumen – Super pave concepts – Recycling of bituminous courses.

Module III (13 Hours)

Rigid Pavements -Introduction – Construction Practices – Concrete Mix Design – Formwork – Dewatering – Joints – Maintenance.

Module IV (14 Hours)

Machineries and Latest Advancements -Road making machineries – road formation, bituminous constructions, road surface evaluation -methods to improve bitumen quality – rheological and chemical additives – polymer modified bitumen – super pave concepts – recycling of bituminous courses.

References:

1. Yoder and Witczak, '*Principles of Pavement Design*', John Wiley, 1975
2. Huang Yang H., '*Pavement Analysis and Design*', Pearson Education India, 2008
3. Nai C. Yang, '*Design of Functional Pavements*', McGraw Hill, 1972
4. IRC: 37 - 2001, '*Guidelines for the Design of Flexible Pavements*'
5. IRC: 58 - 2002, '*Guidelines for the Design of Rigid Pavements*'
6. Hass and Hudson, '*Pavement Management System*', McGraw Hill Book Co., 1978
7. Mix Design Methods for Asphalt Concrete and other Hot mix types MS 2, Sixth Edition, The Asphalt Institute, 1997
8. IRC 81-1981- '*Tentative Guidelines for Strengthening of Flexible Pavements by Benklman Beam Deflections Techniques*'.
9. Edwin J. Barth, '*Asphalt Science and Technology*', Gordon and Breach Science Publishers, New York, 1984

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 302(D) Management Principles and Risk Analysis

Hours per week: Lecture-3 and Tutorial-1

Objective: To develop a basic understanding of how to conduct and evaluate an uncertainty analysis for a risk assessment

Module I (12 Hours)

Operations Research-Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Post – Optimality Analysis – Transportation and Assignment Problems

Module II (13 Hours)

Production Management- Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control

Module III (14 Hours)

Financial Management-Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting

Module IV (15 Hours)

Decision Theory-Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory

Managerial Economics-Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications

References:

1. Ian Cameron , Raghu Raman ,*Process Systems Risk Management* ,Elsevier,Academic Press (2005)
2. Sadgrove, Kit, *Complete guide to business risk management*, Jaico Publication (1997)
3. Marrison, Chris, *Fundamentals of risk measurements*, Tata Mc Graw Hill, Delhi,(2002)
4. Hans Buhlmann, *Mathematical Methods in Risk Theory*, Springer – Verlag Berlin Heidelberg (1970)

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject. The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 100 marks

Answer any 5 questions by choosing at least one question from each module.

Module 1	Module 1I	Module 1II	Module 1V
Question 1 : 20 marks	Question 3 : 20 marks	Question 5 : 20 marks	Question 7 : 20 marks
Question 2 : 20 marks	Question 4 : 20 marks	Question 6 : 20 marks	Question 8 : 20 marks

CEM10 303 INDUSTRIAL TRAINING

Hours/Week: 6

Objectives: After the completion of Industrial Training:

- *The student gains awareness of issues related to designing and maintaining sophisticated equipments, their management and adopting to new standards as when they are formed*
- *The student learns issues related to managing people in industries*

The students have to undergo an industrial training of minimum two weeks in an industry dealing with Construction Engineering & Management, during the semester break between semester II and semester III, and complete within 15 calendar days from the start of semester III. The students are required to submit a report of the training undergone and present the contents of the report before the evaluation Committee. Evaluation committee will award the marks based on training quality, contents of the report and presentation.

Internal Continuous assessment: 50 Marks

CEM10 304 Master Research Project Phase -1

Hours/Week: 10 hours

Objectives: *The main objective of the Master Research Project is to identify current issues in the area of Construction Engineering and Management. The ability of the student to address contemporary issues and to find practical solutions to these issues increases. Also, continued and self learning skill of the student is enhanced.*

The project work can be a design project/experimental project and/or computer simulation project on any of the topics in *Construction Engineering and Management* area. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to continue their project outside the parent institute, subject to the conditions in Clause 10 of M. Tech regulations. Department will constitute an

Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the master research project phase I during the 3rd semester and Phase II in the 4th semester. Phase I consists of preliminary thesis work, two reviews of the work and the submission of a preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review assesses the progress of the work, preliminary report and future plan of the work to be completed in the 4th semester. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

Internal Continuous assessment:

Reviews	Guide	Evaluation Committee
First Review	50	50
Second Review	100	100
Total	150	150

Semester 4

CEM10 401: MASTERS RESEARCH PROJECT PHASE- II

Hours/Week: 24

Master Research project phase II is a continuation of project phase I started in the 3rd semester. There would be two reviews in the 4th semester, first in the middle of the semester and the second at the end of the semester. First review is to evaluate the progress of the work. Second review would be a pre-submission presentation before the evaluation committee to assess the quality and quantum of the work done. This would be a pre - qualifying exercise for the students for getting approval by the Departmental committee for the submission of the thesis. At least one technical paper is to be prepared for possible publication in journal or conferences. The technical paper is to be submitted along with the thesis. The final evaluation of the project will be external evaluation.

Internal Continuous assessment:

Review	Guide	Evaluation Committee
First Review	50	50
Second Review	100	100
Total	150	150