CURRICULUM, SCHEME OF EXAMINATIONS AND SYLLABUS (2013 SCHEME)

M.TECH in CIVIL ENGINEERING (STRUCTURAL ENGINEERING AND CONSTRUCTION MANANGEMENT)

UNIVERSITY OF KERALA

SEMESTER I

Code No.	Name of Subject	Credits	Hrs / week	End Sem Exam hours	Marks			Remarks
					Internal Continuous Assessment	End Semester Exam	Total	
CMC 1001	Advanced Computational Mathematics	3	3	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End sem exam is conducted by the University
CMC 1002	Dynamics of Structures	3	3	3	40	60	100	do
CMC 1003	Advanced Design of Structures	3	3	3	40	60	100	do
CMC 1004	Construction Management and Planning	3	3	3	40	60	100	do
CSC 1004*	Experimental Stress Analysis and Instrumentation	3	3	3	40	60	100	do
CSC 1005*	Theory of Elasticity	3	3	3	40	60	100	do
CMC 1101	Structural Engineering Lab	1	2	-	100	-	100	No End Semester Examinations
CMC 1102	Seminar	2	2	-	100	-	100	do
	TOTAL	21	22					7 hrs of Departmental Assistance work

SEMESTER II

Code No.	Name of Subject	Credits	Hrs / week	End Sem Exam hours	Marks			Remarks
					Internal Continuous Assessment	End Semester Exam	Total	
CMC 2001	Construction Project Implementation and Review	3	3	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End sem exam is conducted by the University
CSC 2002*	Analysis and design of Earthquake Resistant Structures	3	3	3	40	60	100	do
**	Stream Elective I	3	3	3	40	60	100	do
**	Stream Elective II	3	3	3	40	60	100	do
**	Department Elective	3	3	3	40	60	100	do
CMC 2003	Research Methodology	2	2	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End Semester Exam is conducted by the Individual Institutions
CMC 2101	Advanced Computational Lab	1	2	-	100		100	No End Semester Examinations
CMC 2102	Thesis – Preliminary – Part I	2	2	-	100		100	do
CMC 2103	Seminar	2	2	-	100		100	do
	TOTAL	22	23	---				6hrs of Departmental Assistance work

List of Stream Electives (SEMESTER II)

Stream Elective I – Structural Engineering (Students should select a subject from this group)

CSE 2001* Advanced Pre-Stressed Concrete Design

CSE 2003* Structural Optimization

CME 2001 Stability of Structure

* These subjects are the same as those offered for the Structural Engineering Stream.

Stream Elective II - Construction Management (Students should select a subject from this group)

CME 2002 Production and Materials Management

CME 2003 Project Cost Management

CME 2004 Energy Management in Buildings

List of Department Electives (SEMESTER II)

CMD 2001 Design of Offshore Structures

CMD 2002 Design of Bridges

CMD 2003 Strength and Behaviour of Structural Materials

CMD 2004 Analysis and Design of Sub-Structures

CMD 2005 Geographical Information Systems

CMD 2006 Remote Sensing and its Application

CMD 2007 Quantitative Methods in Construction Management.

CMD 2008 Organizational Behaviour

CMD 2009 Management of Quality and Safety in Construction

CMD 2010 Construction Productivity Improvement

SEMESTER III

Code No.	Name of Subject	Credits	Hrs / week	End Sem Exam hours	Marks			Remarks
					Continuous Assessment	End Semester Exam	Total	
**	Stream Elective III	3	3	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End Semester Exam is conducted by the Individual Institutions
**	Stream Elective IV	3	3	3	40	60	100	do
***	Non- Dept. (Interdisciplinary) Elective	3	3	3	40	60	100	do
CMC 3101	Thesis – Preliminary – Part II	5	14	-	200		200	No End Semester Examinations
	TOTAL	14	23					6 hrs of Departmental Assistance work

List of Stream Electives (SEMESTER III)

Stream Elective III – Structural Engineering (Students should select a subject from this group)

CSE 3001* High Rise Structures

CSE 3002* Engineering Applications of Artificial Intelligence and Expert System

CME 3001 Finite Element Methods

* These subjects are the same as those offered for the Structural Engineering Stream

Stream Elective IV - Construction Management (Students should select a subject from this group)

CME 3002 Civil Engineering Material Science

CME 3003 Construction Methods and Equipment

CME3004 Construction Supervision, Repair and Maintenance of Buildings

CME 3005 Construction Economics and Finance

SEMESTER IV

Code No	Subject Name	Credits	Hrs/ week	Marks					Remarks
				Continuous Assessment		University Exam		Total	
				Guide	Evaluation Committee	Thesis Evaluation	Viva Voce		
CMC 4101	Thesis	12	21	150	150	200	100	600	5 % of the evaluation mark is earmarked for Publication in journal/conference
	Total	12	21	150	150	200	100	600	8 hrs of departmental assistance work

SYLLABUS

SEMESTER I

CMC 1001 ADVANCED COMPUTATIONAL MATHEMATICS

Structure of the Course

Lecture: 3 hrs/ Week	Credits: 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To give awareness to different numerical solutions.
- To impart ability to apply mathematics for finding solutions to real-time problems.

Learning Outcomes

- Understand various computational methods available to solve practical problems
- Enhance the capacity to select appropriate techniques for tackling problems in engineering and science.

Module I

Introduction to numerical methods- errors in numerical methods-Systems of linear algebraic equations- Elimination and factorization methods-ill conditioned systems- symmetric and banded systems- Gauss Seidel iteration for sparse systems. Eigen Value problems- power method- Jacobi method-Practical examples- Systems of non-linear equations- Newton-Raphson method.

Module II

Langrangean and Hermition interpolation- Quadratic and Cubic splines (Examples with equal intervals only)- Data smoothing by least squares criterion- Non- polynomial models like exponential model and power equation- Multiple linear regression-Numerical integration- Romberg integration- Gaussian quadrature- Newton – Cotes open quadrature- Taylor series expansion of functions- Ordinary differential equations- 1^{st} order equations- Solution by use of Taylor series- Euler method and its modifications- Runge- kutta method- Higher order equations of the initial value type- Predictor corrector methods- Milne's method and Hammings method- Stability of solutions.

Module III

Ordinary differential equations of the boundary value type- Finite difference solution- Weighted residual methods for initial value problems and boundary value problems- Collocation method- Sub domain method- Method of least squares- Galerkin's method. Partial differential equations in two dimensions- Parabolic equations- Explicit finite difference method- Crank-Nicholson implicit method- Ellipse equations- Finite difference method- Problems with irregular boundaries.

Note: Stress must be given to structural problems
Assignments must be computer oriented

References

1. Chapra S.C. and R.P.Canale "Numerical Methods for Engineers" McGraw Hill 2006.
2. Smith G.D. "Numerical solutions for Differential Equations" McGraw Hill
3. Ketter and Prawel "Modern Methods for Engineering Computations" McGraw Hill
4. Rajasekharan S. "Numerical Methods in Science and Engineering"S Chand & company 2003.
5. Rajasekharan S. "Numerical Methods for Initial and Boundary value problems," Khanna publishers 1989.
6. Terrence J.Akai "Applied Numerical Methods for Engineers",Wiley publishers 1994.

Structure of the Question paper

For the end semester examination there will be three questions from each module out of which two questions are to be answered by the students.

CMC 1002 DYNAMICS OF STRUCTURES

Structure of the Course

Lecture: 3 hrs/ Week	Credits: 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To understand the behaviour of structures under dynamic loads
- To familiarise with the dynamic analysis of structures subjected to time varying loads

Learning Outcomes

- Will be equipped with the analytical tools required to determine the dynamic response of structures
- Will serve as a pre-requisite to study the subject "Analysis and design of earthquake resistant structures"

Module I

Vibration studies and its importance to structural engineering applications. Reviewof damped and undamped free vibration of single degree of freedom systems - forced vibration of damped and undamped single degree of freedom systems. Response of single degree of freedom systems to harmonic, rectangular and triangular impulses. Response to general dynamic loading – Impulse response function, Duhamel's integral. Response to support motion.Vibration Isolation – Transmissibility.

Module II

Numerical solution of single degree of freedom systems-Central differenceMethod, average acceleration method, Wilson theta method, Netmark beta method.Multi degree of freedom systems-Lumped and consistent mass- Idealisationofmultistory frame for dynamic analysis-Natural frequencies and mode shapesOrthogonality of normal modes-Mode superposition method of analysis.

Module III

Multi degree of freedom systems subjected to support motion.Response spectrum – response spectrum analysis of multi degree of freedom systems.Distributed parameter systems-undamped free and forced vibration analysis of simply supported beams.Variational formulation of equations of motion- Lagrange's equations.

References

1. Clough R.W. and Penzien J *Dynamics of Structures* McGraw Hill, New Delhi..
2. J.M. Biggs *Introduction to Structural Dynamics*, McGraw Hill, New Delhi.
3. Anil K Chopra *Dynamics of Structures-Theory and Applications to Earthquake Engineering*,Pearson Education, New Delhi.
4. Weaver W, Timoshenko S P, Young D H, *Vibration Problems in Engineering*, John Wiley &Sons,USA.
5. Mario Paz,*Structural dynamics Theory and Computation*,CBS Publishers and Distributors, Delhi.

6. Mukhopadhyay M, *Structural Dynamics - Vibrations and Systems*, Ane Books India, Delhi.
7. Hurty W.C. and M.F.Rubeinstein*Dynamics of Structures*, Prentice Hall.

Structure of the Question paper

For the end semester examination there will be three questions from each module out of which two questions are to be answered by the students.

CMC 1003 ADVANCED DESIGN OF STRUCTURES

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

This course is designed to

- Provide the ability in analysis and design of basic reinforced concrete components
- Study of advanced topics including theory and design of reinforced concrete structures

Learning Outcomes

- Understand the theory and design of the main elements in reinforced concrete structures
- Understand the behaviour of reinforced concrete structures
- Carry out calculations on safety verification of reinforced concrete members
- Understand the design of special reinforced concrete members and components

Module I

Review on Basic theory and design philosophies-Advanced theory in Stress-strain characteristics of concrete under uniaxial and multiaxial states of stress - confined concrete-Effect of cyclic loading on concrete and reinforcing steel. Stress block parameters-Failure criteria for concrete. Design concepts-Limit state method-comparison of different codal regulations- design of reinforced concrete members in flexure, flexural shear, torsion-combined with flexure and flexural shear. Analysis and design of compression members-slender columns, including biaxial bending, eccentric tension .Estimation of deflection-immediate and long term deflection- control of cracking, estimation of crack width in RC members, codal procedures on crack width computations

Module II

Design of special RC members- Analysis of shear walls- distribution of lateral loads in uncoupled shear walls, Shear wall frame interactions. Design of concrete corbels, deep beams, ribbed slabs, pile caps.

Module III

Strut and Tie Models - Development- Design methodology- selecting dimensions for struts-ACI Provisions- Applications. RCC beam – column joints- classification – shear strength-design of exterior and interior joints- wide beam joints. Yield line analysis of slabs, yield line mechanisms-equilibrium and virtual work method, Hillerborg's strip method. Limitations of yield line theoryMoment redistribution in continuous beams.

References

1. Arthur. H. Nilson, David Darwin and Charles W Dolan, *Design of Concrete Structures*, TataMcGraw Hill, 2004
2. Park, R. and Pauley, T., *Reinforced Concrete Structures*, John Wiley. 1976
3. Pillai ,S.U. and Menon, D., *Reinforced Concrete Design*, Tata McGraw-Hill.2003
4. Varghese,P.C., Limit State Design of Reinforced Concrete, Prentice-Hall. 2005

5. IS 456 –2000, Indian Standard for Plain and Reinforced Concrete- Code of Practice, NewDelhi
6. American Concrete Institute, Building Code Requirements for Structural Concrete (ACI 318-02)and Commentary (ACI 318R-02)

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

CMC 1004 CONSTRUCTION MANAGEMENT AND PLANNING

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

This course is designed to

- Provide the student with an in-depth knowledge in construction planning
- Study of advanced topics in construction economics, contracts and project planning and control

Learning Outcomes

- Understand the theory and problems in construction economics
- Understand the process of bidding and awarding construction contracts
- Understand the theory and practice in construction planning scheduling and control

Module – I

Construction project management – types of projects – life cycle of a construction project – computer applications in management – techno-economic feasibility study – construction economics – time value of money – cash flow diagrams – using interest tables – sources of funding – comparing alternative proposals – break-even analysis – depreciation - cost benefit analysis – rate of return analysis – replacement analysis

Module – II

Construction contract – bidding process – types of contracts – contract documents – important clauses in construction contracts –mistakes in bids – breach of the contract – contract changes – differing site conditions – delays, suspensions and terminations – liquidated damages, force majeure and time extensions – CPWD contract conditions – FIDIC form of contract agreement – dispute resolution

Module – III

Project planning and control – Gantt charts – work breakdown structures – network representation – activity on arrow – activity on node - critical path method (CPM) – network analysis (CPM) – network crashing – resource planning – earned value analysis – PERT – introduction to lean construction

REFERENCES

1. Kumar NeerajJha,*Construction Project Management Theory & Practice* , Pearson
2. Courtland A Collier, William B Ledbetter,*Engineering Cost Analysis*, Harper and Row Publishers, New York
3. Punmia B C,*Project Planning and Control with PERT and CPM*, Laxmi Publications
4. Srinath L.S.,*PERT and CPM - Principles and Applications*, Third edition ,Affiliated East-West Press Pvt. Ltd., New Delhi
5. Jerome D. Wiest and Ferdinand K. Levy,*A Management Guide to PERT / CPM with GERT/ PDM / DCPM and other networks*, Second edition , Prentice Hall of India Pvt. Ltd., New Delhi

6. B. Sengupta and H.Guha,*Construction Management and Planning*,Tata McGraw Hill, New Delhi
7. Construction Project Management Planning Scheduling & Controlling K KChitkara, Tata McGraw Hill,New Delhi
8. Stuart H. Bartholomew Construction Contracting: Business and Legal Principles (2nd Edition) , Prentice Hall

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

CSC 1004* EXPERIMENTAL METHODS AND INSTRUMENTATION

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3

Internal Continuous Assessment : 40 Marks

End Semester Examination : 60 Marks

Course objectives

- Design experiments related to stress analysis problems
- Learn methodology for conducting laboratory and field experiments
- Analyse and interpret experimental observations and results

Learning outcomes

- Capability to provide suitable instrumentation for conducting experiments
- Acquire capacity to organize laboratory experiments for project and thesis works
- Building capacity to conduct destructive and nondestructive experiments as a practicing engineer

Module I

The measurement system: Purpose Structure and Elements - Characteristics of measurement system - Accuracy, Precision, Repeatability; Calibration – Standards and evaluation; Dynamic Characteristics – zero order, first order and second order instruments.

Measurement of Strain: Electrical resistance strain gauges - Gauge materials - gauge construction – gauge factor; Vibrating wire strain gauges; strain gauge bridges – Potentiometric and Wheatstone bridge - sensitivity –Strain Gauge rosettes

Force transducers: Load cells different types – design of force transducers; Force balance pressure gauges – construction - sensitivity.

Module II

Measurement of displacement: Potentiometers – different types; Linear variable differential transformer – principle and working.

Measurement of acceleration: Accelerometers - Characteristics of Accelerometers – types- design of accelerometers – calibration techniques - Integration technique for displacement from acceleration.

Photo elasticity- use of polarised light - Maxwell's law - Polariscopes and their use; Photoelastic model materials ; Two dimensional photo elasticity - analysis and reduction of data.

Module III

Non Destructive Testing Methods- Ultrasonic Methods; Hardness methods - Rebound Hammer; Core sampling technique; Pullout experiment; Detection of embedded reinforcement.

Indicating & recording elements – Chart recorders – Cathode ray oscilloscope; Computer based data acquisition systems – structure and components.

Statistical Analysis - Errors in measurement, Best estimate of true value, Normal Distribution, Confidence level.

References

1. Bently J P - *Principles of Measurement Systems* – Longman, 1995
2. Nakra B.C &Chaudhry - *Instrumentation Measurement & Analysis* - Tata McGraw Hill, 2004
3. Adams L F - *Engineering Measurements and Instrumentation* – English University Press, 1975
4. Doebelin E O - *Measurement Systems Application & Design* - McGraw Hill, 2003
5. Dally J W & W F Riley – *Experimental Stress Analysis* - McGraw Hill, 1991

Structure of the Question paper

For the End Semester Examination there will be three questions from each module out of which two questions are to be answered by the students.

CSC 1005* THEORY OF ELASTICITY

Structure of the Course

Lecture : 3 hrs/ Week	Credits: 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To understand the behaviour of linear elastic solids under loads
- Provide a firm foundation for more advanced courses, for research and practise in civil engineering fields
- To provide the student with various solution strategies while applying them to practical cases

Learning Outcomes

- Understand concepts, principles and governing equations in dealing with elastic solids
- Understand the methods for solving elastic boundary value problems
- To obtain skill and capability in civil engineering in analysing and solving problems

Module I

Analysis of stress and strain in 3D:
Definition of stress at a point – Stress tensor – Equilibrium equations – Stress on arbitrarily oriented plane – Transformation of stress – Principal stress - Stress invariants – Octahedral stresses – Traction boundary conditions, Hydrostatic and Deviatoric Stress Tensors.
Strain tensor – Strain displacement relations for small deformations – Compatibility conditions – Strain transformations – Principal strains – Strain invariants.
Stress Strain relations :Generalised Hooke's law – Reduction in number of elastic constants for orthotropic, transversely isotropic and isotropic media. Boundary value problems of elasticity – Displacement, Traction and Mixed types.Navier's Equations, Beltrami-Michell's Equations.Saint Venant's principle.Uniqueness of Solution

Module II

Two dimensional problems in Rectangular coordinates:
Plane stress and plane strain problems – Airy's stress function - Solution by polynomials – Bending of cantilever loaded at free end., Bending of simply supported beam with udl.
Two dimensional problems in polar coordinates:
General equations- Equilibrium equations, Strain displacement relations and Stress strain relations. Biharmonic equations and Airy's stress functions.
Problems of axisymmetric stress distributions - Thick cylinders - Stress concentration due to circular hole in plates (Kirsch's problem).

Module III

Torsion of prismatic bars:SaintVenant's Semi inverse and Prandtl's stress function approach – Torsion of Straight bars – Elliptic and Equilateral triangular cross section. Torsion of thin walled open and closed tubes, Membrane Analogy
Plasticity: Basic concepts and yield criteria; Equations of plasticity, Theories of strength, Yield criteria, elasto-plastic analysis of torsion and bending problems.

References

1. Timoshenko.S.P and Goodier. J.N., Theory of Elasticity, McGraw Hill, 2010
2. Srinath.L.S., Advanced Mechanics of Solids, Tata McGraw Hill, 2008
3. Sokolnikoff. I.S., Mathematical theory of Elasticity, Tata McGraw Hill
4. Ameen.M., Computational Elasticity, Narosa Publishing House, 2005
5. Boresi.A.P., Schimidt.R.J., Advanced Mechanics of Materials,John Wiley, 2002
6. T.G.Sitharam ., Applied Elasticity, Interline publishing, 2008
7. Phillips, Durelli and Tsao, Analysis of Stress and Strain, McGraw Hill Book.

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

CMC 1101 STRUCTURAL ENGINEERING LAB

Structure of the Course

Lab : 2 hrs/ Week Credits : 1
Internal Continuous Assessment : 100 Marks

Course Objectives

- Practical training for conducting experiments related to structural engineering.
- Capability to use softwares for analysis of experimental data.

Learning Outcomes

- Acquire capacity to organise experiments for project and thesis works.
- Ability to analytically study the experimental results.

List of Experiments:

1. Review of testing methods of cement, coarse aggregate and fine aggregate as per Indian Standards.
2. Study of various instruments used for determining the material properties of concrete, steel, SCC etc
3. Design of concrete mixes.
4. Study of instruments used for determining the durability of materials
5. Calibration of various instruments and equipment used in the lab
6. Experimental study of behaviour of
   a) RCC structural elements
   b) Steel structural elements
7. Accelerated curing experiments for concrete.
8. Non- destructive testing of concrete
   a) Rebound hammer
   b) Core cutting
   c) Ultrasonic pulse velocity
   d) Pullout test
   e) Detection of embedded reinforcements
9. Study of computing techniques for numerical analysis of experimental data, error analysis and curve fitting.

The CA marks shall be awarded on the basis of performance in the laboratory, work report/record of experiments and a viva voce examination conducted at the end of the course.

CMC 1102 SEMINAR

Structure of the Course

Duration : 2 hrs/ Week Credits : 2
Internal Continuous Assessment : 100 Marks

The student has to present a seminar in one of the current topics in the stream of Structural Engineering. The student will undertake a detailed study based on current published papers, journals, books on the chosen subject, present the seminar and submit seminar report at the end of the semester**.**

Distribution of Marks
Seminar Report Evaluation – 40 marks
Seminar Presentation – 60 marks

SEMESTER II

CMC 2001 CONSTRUCTION PROJECT IMPLEMENTATION AND REVIEW

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

This course is designed to

- Provide the student with an in-depth knowledge in construction management
- Study of advanced topics in construction management which includes productivity improvement, quality management and safety management

Learning Outcomes

- Understand the theory and problems in construction productivity improvement
- Understand the theory and problems in quality and safety management

Module – I

Execution of works – measurement – payment – productivity – factors influencing productivity – sources of lost time – factors that improve productivity – work sampling – foreman delay survey – crew balance chart – flow diagram and process charts

Module – II

Quality management overview – total quality management concepts – quality assurance and quality control – Deming, Juran and Crosby's philosophies – tools of quality – statistical quality control – control charts – costs of poor quality – six sigma concepts – introduction to ISO 9001: 2000 – quality manuals

Module – III

Accident theories – statistics and safety – cost of accidents – problem areas in construction safety – fall protection – safety incentives – safety program components – zero accident concepts – safety audits and safety laws – occupational health issues in construction – importance of ergonomics – analysis of safety manuals

References

1. Construction Management and Planning – B. Sengupta and H. Guha (Tata McGrawHill Publishing company Pvt Ltd. , New Delhi)
2. Productivity Improvement in Construction – Clarkson Oglesby, Henry Parker, Gregory Howell (McGrawHill Book Company , Inc.)
3. Construction Safety – Jimmie Hinze, Prentice Hall Inc, 1997
4. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001
5. Principles of Construction Safety – Allan St John Holt, Blackwell Sciences Ltd.
6. Construction Project Management Theory & Practice – Kumar NeerajJha, Pearson India
7. Managing For Total Quality – From Deming to Taguchi and Statistical Process Control, N. Logothetis, Prentice Hall of India Pvt Ltd.
8. Construction Quality Management, S L Tang, Syed M Ahmed, Raymond T Aoieong, S W Poon, Hong Kong University Press, 2005

9. Quality Management in Construction Projects – Abdul RazzakRumane, CRC Press, Taylor & Francis Group

Structure of the Question paper

For the End Semester Examination the question paper will consist of 20% problems and 80 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

CSC 2002* ANALYSIS AND DESIGN OF EARTHQUAKE RESISITANT STRUCTURES 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To impart awareness about the effect of earthquakes on structures.
- To study IS code provisions for the analysis, design and detailing of earthquake resistant structures

Learning Outcomes

- Understand various aspects of earthquake engineering
- Capable of design and detailing of earthquake resistant structures
- Awareness about disaster management due to earthquakes.

Module I

Elements of earthquake engineering- characteristics of ground motion – earthquake intensity and magnitude- recording instruments -seismic zoning- earthquake effects on different types of structures- Effect of architectural features and structural irregularities- review of damages during past earthquakes

Module II

Principles and guidelines for earthquake resistant design of structures- Design lateral forces- Static analysis – Dynamic analysis- Shear walls

Module III

IS Code provision for design and detailing for earthquake resistance- reinforcement detailing for members and joints- design examples. Repair and rehabilitation of damaged structures- case studies- methods for disaster mitigation- Vulnerability assessment and seismic evaluation of structures – vulnerability reduction

References

1. IS: 1893-2002, Indian Standard criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi
2. IS: 4326-1993, Indian Standard code for practice for Earthquake Resistant Design and Construction of Buildings, Bureau of Indian Standards, New Delhi.
3. IS: 13920-1993, Indian Standard Ductile Detailing of RCC Structures subjected to seismic forces- Code of practice, Bureau of Indian Standards, New Delhi
4. SP: 22-1982, Explanatory Handbook on codes of Earthquake Engineering, Bureau of Indian Standards, New Delhi
5. PankajAgarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice- Hall of India, New Delhi.
6. Anil K Chopra, Dynamics of Structures, Prentice- Hall of India, New Delhi.
7. S. K. Duggal-Earthquake Resistant Design of Structures-Oxford University Press-2007

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design or Analysis problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

STREAM ELECTIVE I – Structural Engineering

(Students should select one subject from this group)

CSE 2001* ADVANCED PRE-STRESSED CONCRETE DESIGN 3 – 0 – 0 - 3

Structure of the Course

Lecture: 3 hrs/ Week	Credits: 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To impart to students the knowledge of methods of prestressing, analysis and design of various prestressed concrete elements under relevant codal provisions

Learning Outcomes

- Understand and use suitably the different concepts of prestressing.
- Comprehend the design of various prestressed concrete members used in practice

Module I

Basic concepts and brief history of prestressing, advantages and limitations of prestressing, types of prestressing, prestressing systems and devices, concrete and steel used in prestressed concrete, losses in prestress, analysis of members under flexure,shear and torsion.

Module II

Design of axially loaded members, flexural members – Type I and Type II sections, limiting zone, design of end block, design for shear and torsion, calculation of deflection and crack width, detailing of reinforcement, design of one way and two way slabs, analysis and design of continuous beams.

Module III

Composite construction: Types, analysis and design. Concept of partial prestressing. Circular prestressing: Analysis and design of pipes and water tanks,Design of prestressed concrete bridge decks.

References

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi 1998.
2. Mallick S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd.1997.
1. Rajagopalan, N, Prestressed Concrete, Alpha Science, 2002
2. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990
3. Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay 1995.
4. IS 1343: 1980 Indian Standard Code of Practice for PrestressedConcrete
5. IS 456: 2000 Indian Standard Code of Practice for Plain and Reinforced Concrete

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40% Theory. There will be three questions from each module, out of which two questions are to be answered by the students.

CSE 2003* STRUCTURAL OPTIMISATION3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- The ability to identify the importance of optimization in the engineering field
- Should be able to use optimization techniques for real life time applications
- Ability to apply optimization concepts for solving multi task applications

Learning Outcomes

- Understand various optimization methods
- Understand capabilities of optimization programmes
- Understand, analyse various techniques and apply them for real time applications

Module I

Problem formulation with examples- Single Variable Unconstrained Optimization Techniques – Optimality Criteria - Interpolation methods -Gradient Based methods

Module II

Multi Variable Unconstrained Optimization Techniques – Optimality Criteria.
Unidirectional Search - Direct Search methods - Simplex method - Gradient based methods - Constrained Optimization Techniques –Classical methods - Linear programming problem

Module III

Indirect methods - Direct methods Specialized Optimization techniques - Dynamic programming, Geometric programming, Genetic Algorithms.

References

1. Rao S. S., Engineering Optimisation – Theory and Practice, New Age International.
2. Deb, K., Optimisation for Engineering Design – Algorithms and examples, Prentice Hall.
3. Kirsch U., Optimum Structural Design, McGraw Hill.
4. Arora J S. Introduction to Optimum Design, McGraw Hill
5. Rajeev S and Krishnamoorthy C. S., Discrete Optimisation of Structures using Genetic Algorithms, Journal of Structural Engineering, Vol. 118, No. 5, 1992, 1223-1250.

Structure of the Question paper

For the End Semester Examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students.

CME 2001 STABILITY OF STRUCTURES 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- Provides students a strong background in buckling phenomenon, buckling in columns, beam columns, frames, plates and shells
- Gives an idea of situations where the different structures are susceptible to buckling

Learning Outcomes

- Students become aware of the actual situations where stability becomes a governing factor

Module I

Buckling of Columns – Introduction – Concepts of Stability – Methods of Neutral Equilibrium – Euler Column – Eigen Value Problem – Axially Loaded Column – Effective Length Concept and Design Curve

Large Deformation Theory for Columns.TheBehaviour of Imperfect Columns.Eccentrically Loaded Column. Inelastic Buckling of Columns- Double Modulus Theory- Tangent Modulus Theory

Energy method for calculating critical loads – Rayleigh Ritz Method – Galerkin Method – Numerical Methods – Matrix Stiffness Method- Flexural Members and Compression Members

Module II

Buckling of Built up Columns, Non-prismatic members- Effect of shear on critical Loads

Beams and Beam Columns – Introduction– Beam Column with Concentrated and Distributed Loads – Effect of Axial Load on Bending Stiffness.Design of Beam Columns- Interaction Formula.

Torsional Buckling. Torsional and Torsional – Flexural Buckling of Columns, Lateral Buckling of Beams. Continuous beams with axial load.

Module III

Buckling of Frames – Introduction – Modes of Buckling – Critical Load Using Neutral Equilibrium Methods.

Stability of a frame by Matrix Analysis

Buckling of Plates – Differential Equation of Plate Buckling – Critical Load of a plate uniformly compressed in one direction. Tension field behavior in Plate Girder Webs Postbuckling behavior of axially compressed plates. Instability of shells

References

1. S. P. Timoshenko, J. M. Gere. “Theory of Elastic Stability”, McGraw Hill Book Co.,2009
2. A. Chajes, “Principles of Structural Stability Theory”, Prentice Hall Inc.,1974
3. Iyenger, N.G.R. “Structural Stability of columns and plates”, Affiliated East west press Pvt Ltd., 1990.
4. F. Bleich “Buckling Strength of Metal Structures”, McGraw Hill Book Co., 1975

5. H. G. Allen , P. S. Bulson, " Background to Buckling", McGraw Hill Book Co.,1980
6. T. V. Galambos, " Structural Members and Frames", Prentice Hall., 1968
7. D. O. Brush and B. O. Almroths," Buckling of Bars, Plates and Shells", 1975
8. Ashwini Kumar, "Stability Theory of Structures" McGraw Hill Book Co., 1985

Structure of the Question paper

For the end semester examination there will be three questions from each module out of which two questions are to be answered by the students.

STREAM ELECTIVE II Construction Management

(Students should select one subject from this group)

CME 2002 PRODUCTION AND MATERIALS MANAGEMENT 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To give an idea of material management in industries as well as in sites, encompassing material planning, store functions, inventory and related costs, replenishment etc.
- Deals with related concepts like Value Engineering, Standardization, Selective Control etc.
- To give an insight into the potential of computers in material management.

Learning Outcomes

- Understand methods of inventory management
- Able to use computer applications in material management

Module I

Material management functions-standardization-codification-simplification-diversification-stores-stores functions

Module II

Inventory management - types of inventory - inventory control - costs associated with inventory - Selective control - ABC analysis - Economic order quantity - Replenishment systems - Perpetual Review system - periodic review system - Quantity to be recouped.

Module III

Production Planning and control functions - loading and scheduling- aggregate production planning Cost reduction through materials management- standardization and variety reduction-value analysis- value function- cost and worth- selection of items for value analysis- techniques-value analysis job plan - Computer application in material management-ideal areas for computerization.

References

1. Industrial Purchasing and Effective Material Management – Raymond R Calton& Walter F Rohrs.
2. Operation Management –Theory and Problems –Joseph G Monks.
3. Integrated Concept of Material Management – N.M. Sha
4. Materials Management and Inventory Control – A. K. Dutta.
5. Principles of Inventory and Materials Management – Richard J. Tersine (Prentice Hall).

Structure of the Question paper

For the End Semester Examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students.

CME 2003 PROJECT COST MANAGEMENT 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To introduce concepts in estimation of project cost
- To impart importance of project cost and value management
- To give an overview of various methods of cost control

Learning Outcomes

- Understand methods of preparing project estimates
- Understand various cost control methods in construction project management

Module I

Client's estimation of project cost - Approximate methods of estimation – types of estimates – methods of structuring project costs – illustrative cases in preparation of estimate – contractor's estimation of project cost – determining bid price – bidding and estimation practices in Indian construction industry.

Module II

Project cost and value management – Project cost management – collection of cost related information – cost codes – cost statement – value management in construction – steps in the application of value engineering – introduction to whole life costing

Module III

Cost control – S curve – unit costing – cost control methods – cost-value reconciliation - contract variance unit costing - earned value method – illustration of cost control systems

References

1. Construction Project Management Theory & Practice – Kumar NeerajJha , Pearson
2. Building Estimation ,costing and valuation- Chakraboorthy
3. Construction Management and Planning – B .Sengupta and H .Gha (Tata McGrawhill Publ. Company Pvt Ltd., New Delhi)
4. Halpin,D.W., " Financial and cost concepts for construction Management ", John Wiley and Sons, New York, 1985.
5. Construction Cost Management Learning from case studies - Keith Potts, Taylor & Francis

Structure of the Question paper

For the End Semester Examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students.

CME 2004 ENERGY MANAGEMENT IN BUILDINGS 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To introduce concepts of energy efficient building construction
- To impart importance of Sustainable development

Learning Outcomes

- Understand various concepts in energy management in buildings
- Insight into minimum requirements for the energy-efficient design and construction of buildings.

Module I

Energy scenario – Basics of Energy and its various forms- Energy Management and audit Need for the Energy Conservation Concept of conventional, non-conventional, renewable, non-renewable energy sources Application of non conventional and renewable energy sources- Solar, wind, bio, hydro and tidal energy sources

Module II

Thermal performance characteristics of building elements Passive, active and hybrid systems of thermal comfort ,Energy efficient technologies in lighting, HVAC systems and electrical systems Role of designing according to the climate, Form, planning, layout, specification for walls and roofs,– Orientation, openings and ventilation, Conservation through landscape design– Shelter for hot-dry, warm-humid, composite climates, Energy efficiency in Traditional Kerala buildings

Module III

Energy Efficient buildings - Relation between Energy Efficiency and Sustainable development -Elements of energy efficient buildings -Introduction to the concepts of Green Buildings – Various rating systems for the assessment of sustainability - Indian systems TERI GRIHA, LEED India rating. Zero energy buildings

Sustainability through Waste minimisation techniques- methodology, 3Rs, Solid Waste Management, Needs of water conservation – water recycling– Rain Water Harvesting.

References

1. Watson Donald, *Climatic Design: Energy Efficient Building- Principles & Practices*, McGraw Hill, New York, 1983.
2. Koenigsberger, Ingersoll, Mayhew and Szokolay, *Manual of Tropical Housing and Building- Part 1 Climatic Design*, Orient Longman, Madras 1984.

3. Annual Reports 2004-05, Ministry of Non-Conventional Energy Sources, Government of India, New Delhi, 2005.
4. Energy Conservation Building Code 2006.International Institute for Energy Conservation,
5. *TERI Energy Data Directory and year book*, The Energy Research Institute, New Delhi, 2000.
6. *Griha Manual*, Ministry of New and Renewable Energy, Government of India, and The Energy and Resources Institute, New Delhi, 2010.
7. *Guide book for National Certification Examination for Energy Managers and Energy Auditors, Vol 1 and 4*, Bureau of Energy Efficiency, New Delhi 2005
8. B.C. Bose, *Integrated Approach to Sustainable Development*, Rajat Publications, Delhi, 2001

DEPARTMENT ELECTIVE

(Students should select one subject from this group)

CSD 2001 DESIGN OF OFFSHORE STRUCTURES

Structure of the course

Lecture: 3hrs/Week	Credits: 3
Internal continuous assessment:	40 marks
End semester Examination:	60 marks

Objective:

The course is designed to expose the students to the elementary design of offshore structures. The students undergoing the course is expected to understand tha basic theory behind the design of offshore structures which includes the evalution of environmental forces viz. Wave force current force & wind load in addition to the imposed and live load. This will also familiarize the students to the design of tubular members, its joint, and fatigue effects.

Outcome:

The students will be capable of taking further advanced research / Design and development projects in the emerging & challenging area of offshore structural design They will also be capable of taking up job assignments in the highly potential area of Offshore and coastal engineering

Module I

Introduction to Ocean oil gas and other resources – near shore structures - Different types of ocean structures and systems - Gravity, fixed, floating semi submersibles, compliant structure-Tension legged platform, guyed tower and Spar Platforms

Basics of wave motion, Wave kinematics, pressure field under wave system, wave energy, Energy propagation (Energy flux or wave power), group velocity in deep and shallow water conditions-related problems.

Wave Transformations- Shoaling, refraction – refraction patterns on different bed configurations-problems considering shoaling and refraction effects, wave reflection wave diffraction, wave breaking in deep water, transitional water and shallow water, types of breakers.

Module II

Environmental load calculation (wind, wave, current and tidal) and design parameters Wave forces on offshore structures Morisons Equation for calculation of wave force on slender tubular members Wave forces on large structures Linear diffraction theory

Basic principles of design of concrete offshore platforms - Jack up platforms, Compliant Platforms - Design principles of - Tension leg platform Spar Platforms.

Design of Tubular members Problems on checking the sufficiency of tubular members under different loading conditions in conformity with the API-Code.

Module Ill

Tubular Joints-different types. Analysis of Joints, Stress concentration factor, (API Code formulae for simple joints only) Fatigue failure-SN curves Cumulative damage ratio Palmgren Miner rule Evaluation of Fatigue life of components

Sub sea pipeline-pipeline safety .Design Process –internal pressure-external pressure. On bottom stability objective- static analysis. Laying Pipe line - different methods

References:

1. Thomas H. Dawson. , "Offshore structural Engineering'' Prentice -Hall
2. Subrata K Chakrabarti, "Wave Hydrodynamics''.
3. Subrata K Chakrabarti, "Hand book of Offshore Engineering (Vol. I & II)''. Elsevier Science, Prentice Hall Inc. Englewood Cliffs, N.J. 1983
4. Hsu Teng H., "Applied offshore Structural Engineering'', Gulf Publishing Company , Texas,
5. George A Antaki, "Piping and pipeline Engineering'', CRC Press / Marcel Dekker Inc., 2003.
6. Gerwick B.C. Morris M D "Construction of Marine & offshore structures" CRC PressLondon
7 . Minoo H Patel Dynamics of Offshore Structures Butterworth
8. API RP-2A Recommended Practice for Planning Designing & Construction of Fixed offshore platforms – Working Stress design – American Petroleum Institute
9. Kyriakides S & Corona E Mechanics of offshore pipelines Elsevier UK.

Question paper:

Duration: 3 Hrs.
There will be three questions from each module. The candidate has to answer any two full question from each module.

Note: No charts, tables, codes are permitted in the Examination hall .If necessary the same shall be given along with the question paper by the question paper setter.

CMD 2002 DESIGN OF BRIDGES

Structure of the course

Lecture: 3hrs/Week	Credits: 3
Internal continuous assessment:	40 marks
End semester Examination:	60 marks

Course Objectives

- To understand the theory and design methods of various forms of bridges.

Learning Outcomes

- Students should be able to select a particular form of bridge to suit the requirements and analyse,design the same.

Module I

Classification and components of bridge. Review of road and railway bridge specifications and IRC provisions.

Foundation and substructure :Types of foundations, Piers and abutments- Forces on piers and abutments, Design of piers and abutments, bed blocks.

Bearings: Concrete, steel and neoprene bearings, Design of elastomeric pad bearings.

Module II

Bridge decks-Grid analysis- Courbons method-Orthotropic plate theory.

R. C. Bridges: Design of R. C bridge decks-slab bridges- Design of T beam bridges and balanced cantilever bridges. Introduction to – continuous girder bridges, box girder bridges, rigid frame bridges and arch bridges

Module III

Pre- stressed Concrete Bridges: Design of single span bridges- Introduction to various forms. Slab bridges-girder bridges-box girder bridges-Steel bridges: Design of plate girder and Pratt truss bridges, Introduction to suspension bridges and cable stayed bridges.

References

1. Johnson Victor D., Essentials of Bridge Engineering, Oxford & IBH Pub. Co.,1987
2. Vazirani V. N., Design of Concrete Bridges,Khanna publishers,2004
3. Jagadeesh T.R and Jayaram M.A, Design of Bridge Structures, Prentice Hall,2004
4. Krishnaraju. N, Design of Bridges, Oxford & IBH Pub. Co.,2010
5. Krishnaraju.N,Prestressed Concrete bridges,CBS Publishers,2010
6. IRC 6-2000,IRC 21-2000,IS 800-2007,IRC 18-1985,IRC 24-2001,IRC 83-1987

Structure of the Question paper

For the end Semester Examination the question paper will consist of 60% design problems and 40% theory. There will be three questions from each module out of which two questions are to be answered by the students.

CMD 2003 STRENGTH AND BEHAVIOUR OF STRUCTURAL MATERIALS

Structure of the course

Lecture: 3hrs/Week	Credits: 3
Internal continuous assessment:	40 marks
End semester Examination:	60 marks

Course Objective:

- To teach the modern trends in material technology and study the performance of modern structural materials with respect to strength and durability.

Learning Outcome:

- Students will become aware of use of modern construction materials, their application in typical locations. May be useful in exposing the students on latest research techniques.

Module I

Microstructure of hardened concrete – Aggregate phase, hydrated cement paste, interfacial transition zone.
Strength of concrete – compressive strength-factors affecting, behaviour of concrete under various stress states.
Dimensional stability of concrete – Elastic behaviour, shrinkage and creep.

Module II

Durability of concrete – physical and chemical causes, concrete exposed to seawater and fire.
Special concretes – properties, mix design and application of lightweight concrete, high-strength concrete, fibre reinforced concrete, polymer concrete, recycled aggregate concrete, self-compacting concrete.

Module III

Steel and metal alloys – structural properties, tests, temperature effects.
Heat treatment of steels, special steels and protection of steel reinforcement.
Materials for thermal insulation, sound insulation and decorative finishes.
Recent developments in the use of glass, plastic, rubber and wood products.

REFERENCES:

1. Concrete – microstructure, properties and materials (3e) : Mehta & Monteiro - Mc Graw hill.
2. Advanced concrete technology (Vol III – Process) : Newmann & Choo - Elsevier (Butterworth Heinemann).
3. Advanced concrete technology : Zongjin Li - John Wiley and sons.
4. Steels – Metallurgy and applications : Llewellyn & Hudd - Butterworth Heinemann.
5. Engineering materials science : Milton Ohring _ Academic Press.
6. Fundamentals of building construction – materials and methods (5e) : Edward Allen & Joseph Iano - John Wiley and sons.

Structure of the Question paper

For the End Semester Examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students.

CMD 2004 ANALYSIS AND DESIGN OF SUBSTRUCTURES 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3

Internal Continuous Assessment : 40 Marks

End Semester Examination : 60 Marks

Course Objectives

- Ability to identify the soil-structure interaction
- Ability to select suitable foundation for different types of structures
- Should be able to analyse and design substructures

Learning Outcomes

- Basic understanding of type and selection of foundations
- To analyse and design foundations

Module I

Introduction to soil-structure interaction - Soil-structure interaction problems. Contact pressure distribution beneath rigid and flexible footings on sand and clay - Contact pressure distribution beneath raft. Selection of foundations. Structural design of spread footing, combined Footing and raft foundation.

Module II

Pile foundation: Introduction - Estimation of pile capacity by static and dynamic formulae- Settlement of single pile - Laterally loaded piles - Brom's method - Ultimate lateral resistance of piles - Pile groups - Consideration regarding spacing - Efficiency of pile groups – Pile Cap-Structural Design of Pile and pile cap

Module III

Retaining Walls-Types - Stability analysis of cantilever retaining walls against overturning and sliding-Bearing capacity considerations- Structural design of retaining walls

Introduction to well foundations – Elements of well foundations – Types – Sinking stresses in wells – Design of well cap, Well steining, well curb, cutting edge and bottom plug

References

1. Swami Saran, Analysis and design of substructures, Oxford and IBH Publishing Company Pvt. Ltd.
2. Donald P. Coduto, Foundation Design: Principles and Practices, Dorling Kinderseley (India) Pvt. Ltd., 2012
3. Bowles J.E., Foundation Analysis and Design (4^{th} Ed.), Mc.Graw-Hill Book Company, NY, 1988.
4. Varghese P.C, Foundation Engineering,Prentice Hall India ,NewDelhi 2005

Structure of the Question paper

For the End Semester Examination the question paper will consist of three questions from each module out of which two questions have to be answered by the students.

CMD 2005 GIS APPLICATIONS IN CIVIL ENGINEERING 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To create general awareness about the principles of GIS

Learning Outcomes

- To enable the students to apply principles of GIS to different complex problems in Civil Engineering

Module I

Geographic information system (GIS) – definition ,components – data acquisition and data management – manipulation and analysis – hydrologic modeling and GIS – Geographic data in the computer – Database structures and database management , data structures for representing the geometry of a spatial phenomena.Raster and vector models .Data input,verification,storage and output

Module II

Co-ordinate systems and geo-referencing –concepts of co-ordinate system-concepts of map projections –classification of map projections selecting a suitable map projection. Creating continuous surfaces from point data- Methods of interpolation, Global interpolation, classification – models, trend surfaces, local, deterministic methods for interpolation –nearest neighbors, inverse distance, spline- digital elevation models, Optimal interpolation using geostatic, Krigging

Module III

Analysis of discrete entities in space, operation on attributes, buffering, connectivity, Spatial analysis using continuous fields, interpolation, spatial filtering, derivatives of continous surface, deriving surface topology and drainage networks, clumping, view sheds, shaded relief, irradiance, spatial analysis in surface water hydrology. Source errors in spatial data, factors affecting reliability of spatial data.

References

Structure of the Question paper

For the End Semester Examination the question paper will consist of three questions from each module out of which two questions have to be answered by the students.

CMD 2006 REMOTE SENSING AND ITS APPLICATIONS 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To create general awareness about the principles of photogrammetry and remote sensing

Learning Outcomes

- To enable the students to process the remote sensing data to apply it for various problems in the area of Civil Engineering

Module I

Fundamental of Photogrammetry : Geometric characteristics of aerial photographs – Photographic scale – Photo co-ordinates and ground co-ordinates – relief displacement – Image parallax – Ground control – Flight Planning
Fundamentals of remote sensing - : Energy sources and radiation principles – Interaction of EM energy with atmospheric particles and surface features – Data acquisition and interpretation – multistage remote sensing concept .

Module II

Types of Satellites , Sensors and Images :
Types of satellites – Orbital path – Swath width – IFOV
Along track and across track scanners . Multi spectral, Thermal and radar images – image resolution – image distortions
Visual image interpretation : elements of image interpretation – image interpretation keys – image interpretation equipment.

Module III

Digital image processing: Image rectification and restoration – image enhancement – image classification
Applications of remote sensing : Land use and land cover mapping – Geologic and soil mapping – terrain classification and evaluation – Water pollution detection – Flood mapping – snow mapping – urban and regional planning

References:

1. T.M. Lillesand and R. W. Kiefer,Remote Sensing and Image Interpretation,John Willey and Sons , 1979
2. F.F.abins (jr),Remote Sesning : Principles and Interpretation,Freeman& Co., San Francisco, 1978
3. R.N. Colwel (Ed),Manual of Remote Sensing , Vol I & II , American Society of Photogrammetry and Remote Sensing, Falls Church , Va (1983)
4. Moffit,Francis,Photogrammetry, 2nd Edn., International Textbook Co., Scranton , 1967

5. Paul R.Wolf,Elements of Photogrammetry, McGraw – Hill Book Co., New York,1974
6. KetihP.B.,Thompson et. Al (Ed),Remote Sensing and Water Resources Management, American Water Resources Association, Urbana Illinos, !973.
7. Mitchell C. W. : Terrain Evaluation
8. Remote Sensing of the Environment- John R Jenson, Pearson Education

CME 2007 QUANTITATIVE METHODS IN CONSTRUCTION MANAGEMENT **3 – 0 – 0 - 3**

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To give awareness to different basic concepts of probability and operations research in engineering

Learning Outcomes

- Understand various optimisation methods in engineering systems.
- Enhance the capacity to apply the theory of optimisation in different varieties of network problems from engineering field.

Module I

Introduction-concepts in probability and statistics-linear programming-formation and solution-transportation and assignment problems.

Module II

Dynamic programming-waiting line models- decision theory- game theory

Module III

Computer applications-network preparation and computation- scheduling and allocation-simulation-solution to problems using appropriate software.

References

1. Operation research – Anintroduction – 5th edition,Handy A Thaha(Prentice Hall of India Pvt Ltd., NewDelhi)
2. Management Science – NA introduction to quantitative analysis for Management-William E Pinney and Donald B. McWilliams(Harper and Row Publishers,New York)

Structure of the Question paper

For the End Semester Examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students.

CMD 2008 ORGANIZATIONAL BEHAVIOUR 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

The course is designed to provide an understanding of organizational behavior, the processes of recruitment, training and development of employees.

Learning Outcomes

It helps one understand the complexities of attitudes and how to bring out the best from individuals and groups.

Module 1

Definition of management – managerial functions – inter relationship between managerial functions - managerial skills – roles of managers.

Overview of Organizational Behaviour-Responding to global and cultural diversity - Foundations of individual behavior – perception - individual decision making – values – attitudes - Analysis and design of jobs - Human Resource Planning - Procurement - Recruitment and selection - Induction and placement - Training and development.

Module 2

Motivation of individuals – theories of motivation - Maslow's theory –Herzberg's model – McClelland's three need model – Vroom's expectancy theory – McGregor's theory.

Leadership – definition – leaders vs. managers – styles of leadership - Theories of leadership – Personality theories – behavioural theories – situational theories.

Module 3

Communication – importance and process – directions of communication – media and types of communication - factors affecting communication – barriers to communication – improving interpersonal and organizational communication -Transactional analysis

References

1. Organizational Behaviour – Fred Luthans, McGraw Hill
2. Organizational Behaviour –Stephen Robbins, Pearson

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

CME 2009 MANAGEMENT OF QUALITY AND SAFETY IN CONSTRUCTION **3 – 0 – 0 - 3**

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

This course is designed to

- Provide the student with an in-depth knowledge in quality management
- To impart knowledge about importance of safety in construction

Learning Outcomes

- Understand the various tools of quality and apply it to construction
- Understand the importance of quality and safety and to develop manuals

Module – I

Construction quality – definitions – inspection, quality assurance and quality control - total quality management concepts – PDCA cycle - quality gurus and their teachings - Deming, Juran and Crosby's philosophies

Module – II

Fundamental statistical concepts - Tools of quality – statistical quality control – control charts acceptance sampling - specifications and tolerances – costs of poor quality – six sigma concepts – introduction to ISO 9001: 2000 – quality manuals

Module – III

Accident theories – statistics and safety – cost of accidents – problem areas in construction safety – fall protection – safety incentives – safety program components – zero accident concepts – safety audits and safety laws – OHSAS - occupational health issues in construction – importance of ergonomics – analysis of safety manuals

References

1. Construction Project Management Theory & Practice – Kumar NeerajJha, Pearson India
2. Managing For Total Quality – From Deming to Taguchi and Statistical Process Control, N. Logothetis, Prentice Hall of India Pvt Ltd.
3. Construction Quality Management, S L Tang, Syed M Ahmed, Raymond T Aoieong, S W Poon, Hong Kong University Press, 2005
4. Quality Management in Construction Projects – Abdul RazzakRumane, CRC Press, Taylor & Francis Group
5. Construction Management and Planning – B. Sengupta and H. Guha (Tata McGrawHill Publishing company Pvt Ltd. , New Delhi)
6. Construction Safety – Jimmie Hinze, Prentice Hall Inc, 1997
7. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001
8. Principles of Construction Safety – Allan St John Holt, Blackwell Sciences Ltd.

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

CMD 2010 CONSTRUCTION PRODUCTIVITY IMPROVEMENT 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- The course is designed to provide an understanding of importance of productivity, tools which can be used to measure construction productivity, productivity improvement methods

Learning Outcomes

- It helps one understand the importance of improving productivity and to solve related problems in construction sites by applying suitable tools and techniques.

Module – I

Introduction – Need for Productivity Measurement – Definitions – Productivity Measurement – MPSA Principles – Quantity Measurement Methods – Performance Factor Calculations and Forecasting – Percentage Complete using Earned Value

Module – II

Factors Influencing Productivity – Sources of Lost Time –Tools to Identify Productivity Loss Productivity Improvement Methods – Influence of Human Factors on Productivity – Motivation – Methods of Motivating for Improved Productivity

Module – III

Introduction to Work Sampling – Tour Approach – Crew Approach – Foreman Delay Survey – Implementation – Crew Balance Charts – Flow Diagrams

References

1. Productivity Improvement in Construction - Oglesby, C., Parker, H., and Howell, G. New York: McGraw Hill, 1989.
2. Managing Performance in Construction, Leonard E. Bernold and Simaan M. AbouRizk, John Wiley & Sons.
3. Construction Productivity Management - Paul O. Olomalaiye, Ananda K.W. Jayawardane, Frank C. Harris, Prentice Hall.
4. Construction Productivity: Measurement and Improvement - James J. Adrian, Stipes Pub LLC.

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

CCC 2003 RESEARCH METHODOLOGY

CMC 2001 ADVANCED COMPUTATIONAL LAB

Structure of the Course

Practical : 2 hrs/ Week	Credits : 1
Internal Continuous Assessment	: 100 Marks
No End Semester Examination	

Course Objectives

- Ability to identify the response of structures subjected to dynamic loading
- Provide a firm foundation for research and practise in civil engineering
- Ability to solve dynamic problems numerically

Learning Outcomes

- Understand concepts and principles involved in structural dynamics
- To train the students to perform experimental work for project and thesis

Details of Experiments

1. Free Vibration of Cantilever beam.
2. Dynamics of simply supported beam subjected to harmonic load.
3. Dynamics of a three storied building frame subjected to harmonic base motion
4. Dynamics of a single storied building frame with planar asymmetry subjected to harmonic base motion
5. Vibration isolation of a secondary system
6. Dynamics of a vibration absorber
7. Dynamics of a four storied building frame with and without an open ground floor
8. Dynamics of a single span and two span beams
9. Dynamics of free standing rigid bodies under base motion (Demonstration only)

Note: Results obtained from experiments may be numerically verified wherever possible.

CMC 2102 THESIS PRELIMINARY PART – I

Structure of the Course

Hours/week: 2 Credits: 2
Internal Assessment : 100 Marks

.

For the Thesis - Preliminary Part I, the student is expected to start the preliminary background studies towards the Thesis by conducting a literature survey in the relevant field. He/she should broadly identify the area of the Thesis work, familiarize with the design and analysis tools required for the Thesis work and plan the experimental platform, if any, required for Thesis work. The student will submit a detailed report of these activities at the end of the semester.

Distribution of Marks

Internal assessment of work by the guide : 50 marks
Internal evaluation by the committee : 50 marks

CMC 2103 SEMINAR

Structure of the Course

Duration: 2 hrs/ Week Credits : 2
Continuous Assessment : 100 Marks

The student is expected to present a seminar in one of the current topics in the stream of Construction Management. The student will undertake a detailed study based on current published papers, journals, books on the chosen subject, present the seminar and submit seminar report at the end of the semester**.**

Distribution of Marks

Seminar Report Evaluation - 40 marks
Seminar Presentation - 60 marks

SEMESTER III

Stream Elective III - Structural Engineering

(Students should select one subject from this group)

CSE 3001* HIGH RISE STRUCTURES 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- The ability to identify the structural systems for various combinations of gravity and horizontal loading considering their functional use and heights.
- Should be able to analyse the behaviour and drift capacities of various high rise structural forms

Learning Outcomes

- Understand behaviour of common high rise structures under gravity and lateral loading
- Understand the drift capabilities of different structural forms

Module I

Definition of tall building-need for constructing tall building-Historic background-factors affecting growth. Design Criteria, Design Philosophy of High Rise structures, Materials, Loading-gravity loading- Dead and live load, live load reduction techniques-sequential loading, Impact loading, Wind Loading, Wind Characteristics, Static and Dynamic wind effects, Analytical and wind tunnel experimental method, Earthquake loading-equivalent lateral force method, modal analysis, Introduction to Performance based seismic design.

Module II

Structural form, Floor systems, Rigid frame Structures- rigid frame behaviour –approximate determination of member forces by gravity loading- two cycle moment distribution, approximate determination of member forces by lateral loading- Portal method, Cantilever method, approximate analysis of drift, Braced frames- Types of bracings-behaviour of bracings-behaviour of braced bents-method of member force analysis-method of drift analysis, Infilled frames- behaviour of infilled frames-stresses in infill-forces in frame- design of infill- design of frame- horizontal deflection.

Module III

Shear wall Structures-behaviour of shear wall structures-proportionate wall systems, non proportionate wall systems- horizontal deflection, Coupled shear walls-behaviour of coupled wall structures-method of analysis, Wall frame structures- behaviour of wall frames, Tubular structures-framed tube structures-bundled tube structures-braced tube structures, Core structures, Outrigger-Braced Structures, Foundations for tall structures-pile foundation-mat foundation, Modelling for analysis for high rise structures – approximate analysis, accurate analysis and reduction techniques, Discussion of various Finite Element Packages for the analysis of High Rise Structures

References

1. Bryan Stafford Smith and Alex Coull, Tall Building structures: Analysis and Design, Wiley-Interscience, New York, 1991.
2. Bungale S Taranath, Structural Analysis and Design of Tall Buildings, Tata McGraw Hill,1988.
3. Kolousek V, Pimer M, Fischer O and Naprstek J, Wind effects on Civil Engineering Structures. Elsevier Publications.1984.
4. Robert L Wiegel, Earthquake Engineering. Prentice Hall, 1970.
5. ATC40- Seismic evaluation and retrofitting of concrete buildings, Seismic safety commission, California 1996.
6. Wolfgang Schuller , High Rise Building structures, JohnWiley and sons,1977.

Structure of the Question paper

For the end semester examination there will be three questions from each module out of which two questions are to be answered by the students.

CSE 3002 * ENGINEERING APPLICATIONS OF ARTIFICIAL INTELLIGENCE AND EXPERT SYSYTEM **3 – 0 – 0 - 3**

Structure of the Course

Lecture: 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- Introduces the different algorithms that can be applied in Artificial Intelligence.
- Impart an idea about how these algorithms can be used to solve Civil Enggproblems

Learning Outcomes

- Students become aware of expert systems for knowledge representation, neural networks forknowledge organization and search techniques for knowledge manipulation.

Module I

Introduction to AI – Definition – Typical AI Problems – Knowledge representation and search – philosophical issues – Requirements of knowledge representation languages – semantic Networks – Frames – Predicate Logic – Rule Based Systems – Forward and Backward chaining – Comparison of different – representation methods. Expert system & Search – Heuristic – Knowledge Engineering – expert System – Designing an Expert System – Backward chaining – Rule based expert systems – Explanation facilities – Bayers's theorem – case study of MYCIN.

Module II

Search techniques, Breadth first search, depth first search, Heuristic search – Hill climbing, Best – first – search, A* algorithm, Graphs and Tree Representation. Problem solving as search, Planning, Game planning – Minimax and alpha – beta proving.Sewarching AND –OR Graph, Optimal Search – The Best path and Redundant Path

Module III

Computer Vision – Different levels of vision processing – Low level processing edge deletion line filling – depth & Orientation information – Object recognition – Practical vision system.Advanced Topics – Machine Learning – Introduction – Genetic Algorithm – Neural Networks – Back propagation – Multi layer network – Applications – Software agents – Robots – different types – applications.

References

1. Alison Cawsey, The Essence of Artificial Intelligence, Prentice Hall Europe, 1998
2. Charniak& McDermott, Introduction to Artificial Intelligence, International Student Edition, Addison Wesley, 1998.
3. Dan W Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India, New Delhi 1992.
4. Winston, Artificial Intelligence,Addison-Wesley, 1992
5. Nilsson, Principles of Artificial Intelligence,Narosa, 1998
6. Elian Rich, Artificial Intelligence, McGraw Hill, 1991
7. Robert J. Schalkoff, Artificial Intelligence an Engineering Approach, McGraw Hill, 1990.

Structure of the Question paper

For the end semester examination there will be three questions from each module out of which two questions are to be answered by the students.

CME 3001 FINITE ELEMENT METHOD 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- To provide an understanding of fundamental knowledge and technique of FEM
- To develop tools to analyse engineering problems using FEM and typical commercial FEA package.

Learning Outcomes

- To analyse and build FEA model for various engineering problems.
- Can be extended to the dynamic analysis of structures

Module I

Basics of elasticity- Equations of equilibrium- Strain-displacement relation- stress-strain (constitutive) relation- Energy principles- Principle of virtual work- Principle of stationary potential energy- Variational formulation- Rayleigh-Ritz method- Introduction to weighted residual methods- Evolution of FEM- Review of direct stiffness method- Outline of the FE procedure.

Module II

Element properties- Displacement functions- convergence requirements- equilibrium and compatibility in the solution- Development of equilibrium equation- Types of finite elements- Development of shape functions for truss, beam and frame elements- CST, LST- Lagrange and Serendipity elements- Plane stress and plane strain problems- Gauss quadrature technique- Development of stiffness matrix for truss and beam elements.

Module III

Development of consistent nodal load vector- patch test- static condensation- Concept of isoparametric formulation- Line element- Plane bilinear element- Subparametric and superparametric elements- Assembly procedure and storage techniques of stiffness matrix, Application of boundary conditions- Solution techniques of equilibrium equation- Introduction to plate and shell elements- Types of 3D elements- Discussion of finite element packages.

References

1. Cook R D et al., Concepts and Applications of Finite Element Analysis, John Wiley & Sons, Singapore.
1. KrishnamoorthyCS,FiniteElement Analysis- Theory and Programming, Tata McGraw Hill, New Delhi.
2. Bathe K J, Finite Element Procedures in Engineering Analysis, Prentice Hall, New Delhi.
3. Zienkiewicz O C and Taylor R W., Finite Element Method, Elsevier Butterworth-Heinemann, UK.
4. Rajasekharan S, Finite Element Analysis in Engineering Design, Wheeler, New Delhi.
5. Chandrupatla T R and Belegundu A D, Introduction to Finite Elements in Engineering, Pearson Education, New Delhi.

6. Hutton D V, Fundamentals of Finite Element Analysis, Tata McGraw Hill Education Private Ltd. New Delhi.
7. Mukhopadhyay M and Abdul Hamid Sheikh, Matrix and Finite Element Analyses of Structures, Ane Books Pvt. Ltd., New Delhi.

Structure of the question paper

For the end semester examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students.

Stream Elective IV – Construction Management

(Students should select one subject from this group)

CME 3002CIVIL ENGINEERING MATERIAL SCIENCE 3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- This paper introduces the development, technology and applications of various engineering materials applicable to civil engineering

Learning Outcomes

- On completion of this course work, the students will be able to undertake research in the area of modern construction materials.

Module – I

Introduction, classification of engineering materials.Atomic structure and bonding.The architecture of solids.Crystalstructure.Mechanical properties. Phase transformation. Alloys and their phase diagrams.Equilibrium microstructure of steel alloys.Heat treatment of steel alloys.Stainless steel, cast iron.Alternative reinforcement for concrete.

Module – II

Brief review on ingredients of concrete.factors influencing properties of concrete. properties of concrete at fresh stage, microstructure of concrete, strength of concrete, elastic behaviour, shrinkage and creep. Special concretes: production, properties and application of high strength concrete, polymer concrete, fibre reinforced concrete, recycled aggregate concrete, self-compacting concrete.

Module – III

Supplementary cementitious materials: silica fume, fly ash, metakaolin, ground granulated blast furnace slag, rice-husk ash.Durability of concrete, physical and chemical causes, concrete at elevated temperature, environmental impact on concrete, corrosion of steel reinforcement.High-performance concrete – materials and application.

References

1. Engineering materials science – Milton Ohring – Academic press.
2. Engineering materials I – Ashby and Jones – Elsevier.
3. Fundamentals of materials science and engineering – Callister – John Wiley & Sons.
4. Materials science and metallurgy – Parashivamurthy – Pearson.
5. Steels: metallurgy and application – Liewellyn&Hudd – Butterworth-Heinemann – Oxford.
6. Concrete – Mindess, Young and Darwin – Prentice Hall.
7. Concrete: microstructure properties and materials – Mehta &Monteiro.
8. Advanced concrete technology – Zongjin Li – John Wiley and Sons.
9. Condensed silica fume in concrete – FIP state of the art report – Thomas Telford, London.

10. Supplementary cementing materials – RafatSiddique and Mohd. Iqbal Khan – Springer.

Structure of the Question paper

For the end semester examination there will be three questions from each module out of which two questions are to be answered by the students

CME 3003 CONSTRUCTION METHODS AND EQUIPMENT3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- This course introduces students to construction equipment and selected construction methods. This includes economy, selection, and technical fundamentals of common construction equipment and construction procedures for civil construction.

Learning Outcomes

- Students will be aware of the latest developments in construction methods and use of suitable equipments.

Module I

Factors affecting selection of equipment and methods -Technical and economic-construction engineering fundamentals-analysis of production output and costs- Modular co-ordination-standardization-mass production and transportation-elements of pre cast and prefabricated construction-prestressing-conventional and modern techniques of construction

Module II

Planning and selection of equipments, for earthmoving, hauling, hoisting, conveying, pneumatic, pumping, aggregate production, concrete production, pile driving, tunneling and road construction applications.

Module III

Concrete construction- batching, mixing, transport, placement, finishing, formwork, scaffolding. Steel construction- fabrication and erection

References

1. Construction Planning, Equipment, and Methods: by Robert L. Peurifoy; Clifford J.Schexnayder; AviadShapira, and Robert L. Schmitt, 8th Edition, McGraw-Hill
2. Fundamentals of Construction Management and Organization by Kwaku A. Tenah& Jose M. Guevara - Reston Publishing Co. Inc.
3. Construction Engineering & Management by Dr. S. Seetharaman – Umesh Publications
4. Construction Equipments and its Planning & Applications by Dr. Mahesh Verma Metropolitan Publishing Co.
5. Construction Equipment & Management by S.C. Khanna - Khanna Publishers.

Structure of the question paper

For the end semester examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students

CME 3004 CONSTRUCTION SUPERVISION, REPAIR AND MAINTENANCE OF BUILDINGS **3 – 0 – 0 - 3**

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- This course introduces students to various methods of record keeping, preparation of checklists, identification of defects and selecting suitable repair techniques.

Learning Outcomes

- Students will be equipped to identify the defects in buildings and propose suitable repair and rehabilitation techniques.

Module I

Functions of construction supervisor-position of construction supervisor-interpretation-importance of estimation in work planning.
Record keeping –muster rolls, books and bills, site registers, materials at site account.

Module II

Works supervision check list-foundation-masonry works- concrete works-steel works-utilities-fininshing items.
Defects in buildings-introduction to defects – defects in steel-defects in timber- defects in sanitary fittings and plumbing.

Module III

Repairing material-repairing materials for defects in timber.
Repair and preventive maintenance techniques-repair of floors- strengthening of stone-concrete and masonry structures-water proofing strengthening of cracked beams columns-foundations.

References

1. A textbook on estimating and accounts by D DKohli& R C Kohli
2. Construction Project Management Theory & Practice – Kumar NeerajJha, Pearson India
3. Construction Management and Accounts by Singh harpal, Tata McGrawhill
4. Construction Management and Planning – B. Sengupta and H. Guha (Tata McGrawHill Publishing company Pvt Ltd. , New Delhi)
5. Engineering & Construction Project Management – KerridgeArther K, Gulf Publishing Company, London.
6. IS 2556 (Parts I to XI), SP 35 – Handbook on water supply and drainage, BIS, New Delhi

Structure of the question paper

For the end semester examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students

CME 3005 CONSTRUCTION ECONOMICS AND FINANCE3 – 0 – 0 - 3

Structure of the Course

Lecture : 3 hrs/ Week	Credits : 3
Internal Continuous Assessment	: 40 Marks
End Semester Examination	: 60 Marks

Course Objectives

- The paper is meant to create awareness in students on the different aspects of construction economics, cost analysis and financial management.

Learning Outcomes

- Student will be able to apply concept of construction economics to evaluate the best among several project alternatives

Module I

Construction economics- time value of money - cash flow, depreciation, taxes, inflation, economic evaluation of alternatives - NPV, rate of return, benefit cost analysis, breakeven analysis, replacement analysis.

Module II

Work pricing, cost elements of contract, bidding and award, revision due to unforeseen causes, escalation. Turnkey activities, project appraisal and project yield.

Module III

Working capital management, financial plan and multiple sources of finance, budgeting and budgetary control, performance budgeting, appraisal through financial statements.

References

1. Engineering Economy – Blank L.T. and A.J. Tarquin, McGraw Hill
2. Construction Project Management Theory & Practice – Kumar NeerajJha , Pearson
3. Engineering Cost Analysis – Courtland A Collier, William B Ledbetter, Harper and Row Publishers, New York

Structure of the question paper

For the end semester examination the question paper will consist of three questions from each module out of which two questions are to be answered by the students

CMC 3101 THESIS PRELIMINARY PART - II

Structure of the Course

Hours/week: 15	Credits: 5
Continuous Assessment	: 200 Marks

The Thesis Preliminary Part -II is an extension of Thesis Preliminary Part I. Thesis Preliminary Part II comprises of preliminary thesis work, two seminars and submission of thesis –preliminary report. The first seminar would highlight the topic, objectives and methodology and the second seminar will be a presentation of the work they have completed till the third semester and the scope of the work which is to be accomplished in the fourth semester, mentioning the expected results.

Distribution of Marks

Internal assessment of work by the guide	: 100 marks
Internal evaluation by the committee	: 100 marks

SEMESTER IV

CMC 4101 THESIS

Structure of the Course

Hours/week: 21	Credits: 12
Continuous Assessment	: 300 Marks
End Semester Examination	: 300 Marks

The student has to continue the thesis work done in second and third semesters. There would be an interim presentation at the first half of the semester to evaluate the progress of the work and at the end of the semester there would be a Pre-Submission seminar before the Evaluation committee for assessing the quality and quantum of work. This would be the qualifying exercise for the students for getting approval from the Department Committee for the submission of Thesis. At least once technical paper is to be prepared for possible publication in Journals/Conferences. The final evaluation of the Thesis would be conducted by the board of examiners constituted by the University including the guide and the external examiner.

Distribution of marks

Internal evaluation of the Thesis work by the guide: 150 marks

Internal evaluation of the Thesis by the Evaluation Committee: 150 marks

Final evaluation of the Thesis Work by the Internal and External Examiners: 300 marks

[Evaluation of Thesis: 200 marks+ Viva Voce: 100 marks *(5% of the marks is ear marked for publication in Journal/Conference)*]– 300 marks