KERALA TECHNOLOGICAL UNIVERSITY

Cluster No. 10 for PG Programs

(Engineering Colleges in Kannur, Wayand & Kasaragod Districts)

Curriculum, Syllabi and Course plan for M. Tech. Degree Program with effect from Academic Year 2015 - 2016

CIVIL ENGINEERING BRANCH

M. Tech.

in

STRUCTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT

FIRST SEMESTER

Exam slot	Course Number	Name	Hours/Week			Internal Marks	End Semester Examination		Credit
			L	T	P		Hrs	Marks	
A	10CE 6201	Advanced Numerical and Statistical Methods	3	0	0	40	3	60	3
B	10CE6103	Theory of Elasticity	3	1	0	40	3	60	4
C	10CE6203	Construction Management	3	0	0	40	3	60	3
D	10CE6107	Advanced Theory and Design of RC Structures	3	1	0	40	3	60	4
E		Elective- I	3	0	0	40	3	60	3
	10GN6001	Research Methodology	0	2	0	100	0	0	2
	10CE6209	Seminar-I	0	0	2	100	0	0	2
	10CE6211	Construction Management Lab	0	0	2	100	0	0	1
	TOTAL		**15**	**4**	**4**	**500**		**300**	**22**

ELECTIVE

10CE6213 Quality Control & Project Safety Management

10CE6215 Modern Construction Materials, Methods and Equipment's

10CE6113 Advanced Concrete Technology

10CE6115 Forensic Engineering

SECOND SEMESTER

Exam slot	Course Number	Name	Hours/Week			Internal Marks	End Semester Examination		Credit
			L	T	P		Hrs	Marks	
A	10CE6202	Construction Personnel Management	3	0	0	40	3	60	3
B	10CE6104	Finite Element Method	3	0	0	40	3	60	3
C	10CE6106	Analysis and Design of Earthquake Resistant structures	3	0	0	40	3	60	3
D		Elective-II	3	0	0	40	3	60	3
E		Elective-III	3	0	0	40	3	60	3
	10CE6208	Mini Project	0	0	4	100	0	0	2
	10CE6212	Structural Engineering Lab	0	0	2	100	0	0	1
	TOTAL		**15**	**0**	**6**	**400**		**300**	**18**

ELECTIVES

SLOT D

10CE6214 Advanced Construction Techniques

10CE6216 Building Service

10CE6218 Experimental Technique and Instrumentation

10CE6116 Composite Structures

SLOT E

10CE6222 Construction Economics and Finance Management

10CE6122 Advanced Pre stressed concrete structures

10CE6124 Analysis and Design of Substructures

10CE6126 High Rise structures

THIRD SEMESTER

Exam slot	Course Number	Name	Hours/Week			Internal Marks	End Semester Examination		Credit
			L	T	P		Hrs	Marks	
A		Elective- IV	3	0	0	40	3	60	3
B		Elective- V	3	0	0	40	3	60	3
	10CE7201	Seminar -II	0	0	2	100			2
	10CE7203	Project Phase 1	0	0	12	50			6
	TOTAL		**6**	**0**	**14**	**230**		**120**	**14**

ELECTIVES

SLOT A

10CE7205 Pavement Construction Practice

10CE7207 Quantitative Techniques in Management

10CE7105 Design of Bridges

10CE7107 Structural Reliability

'SLOT B

10CE7209 Disaster Management

10CE7211 System Integration in Construction

10CE7111 Stability of Structures

10CE7115 Advanced Finite Element Analysis

FOURTH SEMESTER

Course Number	Name	Hours/Week			Internal Marks	End Semester Examination		Credit
		L	T	P		Hrs	Marks	
10CE7204	Project - Phase 2	0	0	23	70	0	30	12
TOTAL		**0**	**0**	**23**	**70**		**30**	**12**

TOTAL NUMBER OF CREDITS: 66

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6201	ADVANCED NUMERICAL AND STATISTICAL METHODS	3-0-0-3	2015

Course Prerequisites

Basic knowledge of Mathematics at UG Level.

Course Objectives

- Get awareness to different numerical and Statistical solutions.
- Impart ability to apply mathematics to finding solutions to real time problems.

Syllabus

Introduction to numerical methods- errors - linear algebraic equations- interpolation- Quadratic and Cubic splines-Ordinary differential equations- 1st order equations- Higher order equations of the initial value type- Predictor corrector methods- Ordinary differential equations of the boundary value type- Partial differential equations in two dimensions- Finite difference method- Problems with irregular boundaries. Basic Statistics, Correlation, method of least squares, Regression, fitting of straight line and parabola, Binominal, Poisson and normal distributions Testing of Hypothesis

Expected Outcomes

The students are expected to apply the theory of elasticity and the analytical techniques for solving practical problems of elasticity.

References

1. Chapra S.C. and Canale R.P. Numerical Methods for Engineers,McGraw Hill

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

5.Rajasekharan S., Numerical Methods for Initial and Boundary value problems, Khanna

6. Terrence J.Akai, Applied Numerical Methods for Engineers, Wiley publishers

7. C.B Gupta , Vijay Gupath An Introduction to statistical Method ,Vikas publications

8. Gupta S.C and Kappr V.K , Fundamental of Mathematical Statics , S. Chand publications

	Course plan		
Module	**Content**	**Hours**	**Semester Exam Marks (%)**
I	Introduction to numerical methods- errors in numerical methods-Systems of linear algebraic equations- Gaussian Elimination method -ill conditioned systems-	6	15
	Eigen Value problems-Power method	2	
II	Langrangean and Hermitian interpolation- Quadratic and Cubic splines (Examples with equal intervals only)	4	15
	Ordinary differential equations- 1st order equations- Solution by use of Taylor series- Higher order equations of the initial value type- Predictor corrector methods. Ordinary differential equations of the boundary value type- Finite difference solution	4	
First Internal Examination			
III	Partial differential equations in two dimensions- Parabolic equations- Explicit finite difference Schmidt method- Crank-Nicholson implicit method- Ellipse equations- Finite difference method- Problems with irregular boundaries.	8	15
IV	Basic Statistics: Sources of Data, Organization of Data, The Histogram, Correlation, Coefficient of correlation, method of least squres, Rank correlation, Regression, fitting of straight line and parabola	6	15
Second Internal Examination			
V	Binominal, Poisson and normal distributions – definitions – simple problems only (Derivation not Included)	6	20
VI	Testing of Hypothesis sampling distributions – test based on normal, T and Chi- Square.	6	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course name	L-T-P-credits	Year of introduction
10CE6203	CONSTRUCTION MANAGMENT	3-0-0-3	2015

Course objectives

The course is designed to provide students a strong background in Understanding the concept of scientific management, the process of bidding and awarding construction contracts and the theory and practice in construction Economy.

Syllabus

Scientific Management, Legal Requirements, Construction contract, Engineering economy, Budgeting, Arbitration

Expected outcome

The students are expected to apply the general principles of construction management in the field of Construction economy. `

Reference

1. Bonny J. B. "Hand book of Construction Management Organization", Van NostrandReinhold New York
2. Robert G Murdick, Joel E. Ros, James and Clegget "Information systems for Modern Management"- second edition, Prentice Hall of India, New Delhi.
3. Collier, William BG. Ledbetter, "Engineering Cost Analysis"- Courtland A., Harper andRow Publishers, New York.
4. Kumar NeerajJha,*Construction Project Management Theory & Practice* , Pearson
5. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M.M.Tripathi Private Ltd., Bombay,
6. Jimmie Hinze, "Construction Contracts", 2nd Edition, McGraw Hill,
7. Joseph T. Bockrath, " Contracts and the Legal Environment for Engineers and Architects", McGraw Hill,
8. Richard Hudson Clough, Glenn A. Sears, "Construction Contracting", J.Wiley,

Course plan

Module	Contents	Hours	Sem. Exam marks
I	**Scientific Management:** Contributions of pioneers in scientific Management - Basic principles of management with special reference to construction industry- construction organization setup.	8	15
II	**Legal Requirements**-Insurance and Bonding-Laws Governing Sale, Purchase and use of Urban and Rural land-	6	15
FIRST INTERNAL EXAM			
III	**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	8	15
IV	Tax Laws-Income Tax, Sales Tax, Excise and customs duties and their influence on construction costs- Labour Administration- Insurance and Safety Regulations-Workmen's Compensation Act.	6	15
SECOND INTERNAL EXAM			
`V	**Budgeting** Capital budgeting, Working capital management, Construction accounting. Appraisal through financial statements-ratio's analysis, Long term Financing..–sources of funding – comparing alternative proposals	6	20
VI	**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	8	20

	Total	42	
CLUSTER LEVEL END SEMESTER EXAMINATION			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6103	**THEORY OF ELASTICITY**	**3-1-0-4**	**2015**

Course Prerequisites

Basic knowledge of applied mechanics at UG Level.

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 field
- To provide the student with various solution strategies while applying them to practical cases

Syllabus

Analysis of stress in 3D - Analysis of strain in 3D - Stress Strain relations - Two dimensional problems in Rectangular coordinates - Two dimensional problems in polar coordinates - Torsion of prismatic bars.

Expected Outcomes

- Understand concepts, principles and governing equations related to the analysis of elastic solids

To obtain skill and capability in analysing and solving problems in Civil Engineering

References

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

	Course plan		
Module	**Content**	**Hours**	**Semester Exam Marks (%)**
I	Analysis of stress 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	10	15

	conditions, Hydrostatic and Deviatoric Stress Tensors. Numerical examples		
II	Analysis of strain in 3D: Strain tensor – Strain displacement relations for small deformations – Compatibility conditions – Strain transformations– Principal strains – Strain invariants, Octahedral strains, Hydrostatic and deviatoric strains. Numerical examples	8	15
First Internal Examination			
III	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. Numerical examples	8	15
IV	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., pure bending of curved beams	10	15
Second Internal Examination			
V	Two dimensional problems in polar coordinates: General equations- Equilibrium equations, Strain displacement relations and Stress strain relations, compatibility 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). Numerical examples	10	20
VI	Torsion of prismatic bars: Saint Venant's Semi inverse and Prandtl's stress function approach – Torsion of Straight bars – Elliptic and Equilateral triangular cross section. Membrane Analogy -Torsion of thin walled open and closed tubes, Numerical examples	10	20
	Total	56	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6107	ADVANCED THEORY AND DESIGN OF RC STRUCTURES	3-1-0-4	2015

Course Prerequisites

Basic knowledge of applied mechanics at UG Level.

Course Objectives

This course is designed to

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

Syllabus

Basic theory and design philosophies-Advanced theory in Stress-strain characteristics of concrete -Failure criteria for concrete. -Estimation of deflection and control of cracking, RCC beam – column joints- Flat Slabs- Design of special RC members-Strut and Tie Models- Development- Design methodology- .Design of concrete corbels, deep beams, ribbed slabs, pile caps. Yield line analysis of slabs, Moment redistribution in continuous beams.

Expected Outcomes

- To design the main elements in reinforced concrete structures
- To study the behaviour of reinforced concrete structures
- To analyse and design flat slabs

To design special reinforced concrete members and components

References

1. Park, R. and Pauley, T., Reinforced Concrete Structures, John Wiley
2. Varghese, P.C., Limit State Design of Reinforced Concrete, Prentice-Hall
3. Arthur. H. Nilson, David Darwin and Charles W Dolan, Design of Concrete Structures, Tata McGraw Hill
4. Subramanian, N., Design of Reinforced Concrete Structures, Oxford University Press.
5. Gambhir, M. L., Design of Reinforced Concrete Structures, PHI Learning Private Limited.
6. IS 456 –2000, Indian Standard for Plain and Reinforced Concrete- Code of Practice, New Delhi
7. ACI 318M-14, American Concrete Institute, Building Code Requirements for Structural Concrete

	Course plan		

Module	Content	Hours	Semester Exam Marks (%)
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.	10	15
II	Estimation of deflection- immediate and long term deflection- control of cracking, estimation of crack width in RC members, codal procedures on crack width computations.	8	15
First Internal Examination			
III	RCC beam – column joints- classification – shear strength-design of exterior and interior joints- wide beam joints.	8	15
IV	Flat Slabs – Structural requirements-Determination of design bending moments-Direct design method – equivalent frame method-comparison of flat slab with two way slab-Openings in flat slabs	10	15
Second Internal Examination			
V	Strut and Tie Models- Development- Design methodology-selecting dimensions for struts- ACI Provisions-Applications. Design of concrete corbels, deep beams, ribbed slabs, pile caps.	10	20
VI	Yield line analysis of slabs, yield line mechanisms-equilibrium and virtual work method, Hillerborg's strip method. Limitations of yield line theory-Moment redistribution in continuous beams.	10	20
	Total	56	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10GN6001	RESEARCH METHODOLOGY	0-2-0	2015

Course Objectives

This course is designed to

1. To attain a perspective of the methodology of doing research;
2. To develop skills related to professional communication and technical report writing.
3. As a tutorial type course, this course is expected to be more learner centric and active involvement from the learners are expected which encourages self-study and group discussions. The faculty mainly performs a facilitator's role

Syllabus

Overview of research methodology - research process - scientific methods -research problem and design - research design process - formulation of research task, literature review and web as a source - problem solving approaches - experimental research - ex post facto research. Thesis writing - reporting and presentation - interpretation and report writing - principles of thesis writing- format of reporting, oral presentation - seminars and conferences, Research proposals - research paper writing - publications and ethics - considerations in publishing, citation, plagiarism and intellectual property rights. Research methods – modeling and simulation - mathematical modeling – graphs - heuristic optimization - simulation modeling - measurement design – validity – reliability – scaling - sample design - data collection methods and data analysis.

Expected Outcomes

- The students are expected to :
- Be motivated for research through the attainment of a perspective of research methodology;
- Analyze and evaluate research works and to formulate a research problem to pursue research;

- Develop skills related to professional communication, technical report writing and publishing papers.

References

1. C.R Kothari, Research Methodology : Methods & Techniques, New Age International Publishers
2. R. Panneerselvam, Research Methodology, Prentice Hall of India, New Delhi.
3. K. N. Krishnaswamy, Appa Iyer Sivakumar, and M. Mathirajan, Management Research Methodology, Integration of Principles, Pearson Education.
4. Deepak Chawla, and MeenaSondhi, Research Methodology – Concepts & Cases, Vikas Publishing House.
5. J.W. Bames, Statistical Analysis for Engineers and Scientists, McGraw Hill, New York.
6. Schank Fr., Theories of Engineering Experiments, Tata McGraw Hill Publication.
7. Willktnsion K. L, Bhandarkar P. L, Formulation of Hypothesis, Himalaya Publication

	Course plan		
Module	**Content**	**Hours**	**Semester Exam Marks (%)**
I	Overview of Research Methodology: Research concepts, meaning, objectives, motivation, types of research, research process, criteria for good research, problems encountered by Indian researchers, scientific method, research design process.	5	15
II	Research Problem and Design : Formulation of research task, literature review, methods, primary and secondary sources, web as a source, browsing tools, formulation of research problems, exploration, hypothesis generation, problem solving approaches, introduction to TRIZ (TIPS), experimental research, principles, laboratory experiment, experimental designs, ex post facto research, qualitative research.	5	15
First Internal Examination			
III	Thesis Writing, Reporting and Presentation : Interpretation	4	15

	and report writing, techniques of interpretation, precautions in interpretation, significance of report writing, principles of thesis writing, format of reporting, different steps in report writing, layout and mechanics of research report, references, tables, figures, conclusions, oral presentation, preparation, making presentation, use of visual aids, effective communication, preparation for presentation in seminars and conferences		
IV	Research proposals, Publications, Ethics and IPR : Research proposals, development and evaluation, research paper writing, layout of a research paper, journals in engineering, considerations in publishing, scientometry, impact factor, other indexing like h-index, citations, open access publication, ethical issues, plagiarism, software for plagiarism checking, intellectual property right (IPR), patenting case studies.	5	15
Second Internal Examination			
V	Research Methods - Modelling and Simulation : Modelling and simulation, concepts of modelling, mathematical modelling, composite modelling, modelling with ordinary differential equations, partial differential equations (PDE), graphs, heuristics and heuristic optimization, simulation modelling..	5	20
VI	Research Methods - Measurement, Sampling and Data Acquisition : Measurement design, errors, validity and reliability in measurement, scaling and scale construction, sample design, sample size determination, sampling errors, data collection procedures, sources of data, data collection methods, data preparation and data analysis.	4	20
	Total	28	
Department Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6209	SEMINAR-I	0-0-2- 2	2015

Course Prerequisites: None

Course Objectives

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

Syllabus:

The student has to present a seminar in one of the current topics in the stream of specialization. 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**.** Seminar I and seminar II shall be offered in first and third semesters. Institutions can advise students belonging to about 50% of number of students in the SECM Stream to opt for Structural Engineering field in Semester 1 for the seminar topic and Construction management field in Semester 3 for the seminar topic and vice versa.

Expected Outcomes :At the end of the course, the student will be able to

- Identify and chose appropriate topic of relevance.
- Assimilate literature on technical articles of specified topic and develop comprehension.
- Prepare technical report.
- Design, develop and deliver presentation on specified technical topic.

Evaluation: The seminar shall be of 30minutes duration and shall evaluate the seminar based on the coverage of the topic, presentation and ability to answer the questions put forward by the committee and the student shall submit typed copy of the paper to the Department in the presence of their classmates. It is mandatory for all the students to attend the presentations of their classmates.

Grades will be awarded on the basis of contents of the paper and the presentation

1. Evaluation of the Report : 30%

2.	Presentation : 40 %
3.	Ability to answer the questions on the topics : 30 %

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6211	CONSTRUCTION MANAGEMENT LAB	0-0-2-1	2015

Course Objectives

- Practical training for resource allocation and leveling using MSP
- Capability to use software's for Quantity take off, Preparation and delivery of the bid or proposal.
- Identify and estimate resources for the items of the project and prepare detailed project schedule**.**

List of Experiments

1. Exercises on
   a. Quantity take off
   b. Preparation of bid document
   c. Delivery of the bid
   for an Engineering construction project
2. Scheduling of a small construction project using MS project / primavera etc including
   a. Manpower Deployment schedule
   b. Equipment deployment Schedule
   c. Financial analysis of the project
   d. Cash Flow analysis
   e. Reports and tracking.
3. Exercise on Valuation : Valuation of land and building using various methods
4. Break up of activities for construction of Residential Building using MS projects
5. Time Estimate for activities and Expected Time calculation using MS projects
6. Exercises on Resource allocation and levelling
7. Drawing a Fishbone diagram of a problem: .The manager of a construction company faces serious problems in coordinating the work. In order to sort out the problem using Cause and Effect Analysis he is asked to find out
   a. The root cause of a problem.
   b. Uncover bottlenecks in the processes.
   c. Identify where and why a process isn't working.
   d. identifies the factors, and adds these to his diagram:
   e. Analysis the diagram and find out major problem.

List of Equipment's / Software's / Tools Requirements

MS OFFICE, MS PROJECT / PRIMAVERA, AutoCAD, PERT MASTER etc

Expected Outcomes. After completion if this course

1. Acquire capacity to organize drawing, estimation, specification and resource allocation for project
2. Ability to use the software package for Analysis, design and detailing of structures.

Assessment :

Practical Records /outputs 40%, Regular Class Viva-Voce 20%, Final Test (Objective) 40%

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6213	QUALITY CONTROL AND PROJECT SAFETY MANAGEMENT	3-0-0- 3	2015

Course Prerequisites

None

Course Objectives

The course is designed to provide students a strong background in the concept of quality , total quality management, and safety management

Syllabus

Quality, quality control , quality policy, planning , quality leaders The PSDA Cycle, Six sigma Quality, Total quality Management- TQM Organization -Consumer satisfaction, Ergonomics, Taguchi's concept of quality, Quality Assurance.-Codes and standards. Quality Inspection, Quality audit, Statistical Quality control, types of control charts, control charts for variables and attributes, Introduction to Safety Management, safety planning and design, Injury and Accidents, Causes, Investigations and Prevention of Accidents, Hazards-Nature, Causes And Control Measures, Safety programmes, Safety measures , Safety assessment

Expected Outcomes

After completing the course

- Able to apply the principles of quality and TQM in construction industry
- Able to identify and apply the safety in Construction organization. `

References

1. James, J.O Brien, "Construction Inspection Handbook - Quality Assurance and Quality Control ", Van Nostrand, New York,
2. Kwaku A., Tenah and Jose M.Guevera, "Fundamental of Construction Management and Organization ",Prentice Hall of India,
3. Juran Frank, J.M. and Gryna, F.M. " Quality planning and Analysis ", Tata McGraw Hill,
4. Jimmy W.Hinze, "Construction Safety ", Prentice Hall Inc.,

Course Plan

Module	Content	Hours	Semester Exam Marks (%)
I	**Quality:** Evolution of quality, definition, elements of quality	3	15
	Quality Control: Definition, Approach to quality control,	3	

	Objectives of quality control, quality characteristics.		
II	**Quality Management**: Quality policy, Quality Planning-tools, Major items in Construction job requiring in quality control.	3	15
	Characteristics of Quality leaders, role of Leaders in quality control, Continuation Process improvement. The PSDA Cycle, Six sigma Quality	4	
First Internal Examination			
III	**Total quality Management:** Definition, TQM Concepts, Basic approach, The Deming's philosophy ,principles of TQM, Benefits of TQM, Involvement of management in TQM	4	15
	TQM Organization -Consumer satisfaction-Ergonomics-Time of Completion-Taguchi's concept of quality	3	
IV	**Quality Assurance** –Objectives, specification. Codes and standards.	2	15
	Inspection –purpose, stage, procedure, methods, technical service for inspection Quality audit-audit cycle.	3	
	Statistical Quality control – definition, advantage, functions, process control, product control, sub-grouping	4	
Second Internal Examination			
V	**Safety Management** - objectives , safety planning and design Injury and Accidents-Definitions of Unsafe Act – Unsafe Condition-Causes, Investigations And Prevention of Accidents.	3	20
	Hazards, Type Of Industrial Hazards-Nature, Causes And Control Measures, Hazard Identifications And Control Techniques -Cost of Construction Injuries	3	
VI	**Safety Programmes** – principles of Safety- Need- Safety measures adopted in work sites.	3	20
	Measurement of Safety Performance, Safety Audit, Problem Areas in Construction Safety- Elements of an Effective and Safety Programme	2	
	Job site Safety assessment- Safety Meetings- Safety Policy, Safety Record Keeping, Safety Culture- safety organization	2	
	Total	42	
CLUSTER LEVEL END SEMESTER EXAMINATION			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6215	MODERN CONSTRUCTION MATERIALS, METHODS AND EQUIPMENTS	3-0-0- 3	2015

Course Objectives

The course is designed for students to familiarize with materials, methods and equipment's in construction field.

Syllabus

Introduction to Modern construction materials, Finishes, Treatments and Construction Chemicals, Metals and Special alloys of steel, Heat treatment in Steels and Tendons, Polymers in Civil Engineering, Weathering, Flooring and Façade materials, Prefabricated Buildings, Pre Engineered Buildings, Tunnel boring methods, Soil improvement techniques, Construction Equipment for different construction operations, Types of Pumps used in construction and Material Handling Equipment's.

Expected Outcomes

The students are expected to select and use the suitable and most efficient materials, methods and equipment's in a construction project.

Reference Books:

1. Peurifoy, R.L. "*ConstructionPlanning Equipment and Methods"*, McGraw Hill. Singapore
2. Sharma S.C. "*Construction Equipment and Management* ", Khanna Publishers New Delhi,
3. Shan Somayaji, *"Civil Engineering Materials* ", 2nd Edititon , Prentice Hall Inc.
4. Mamlouk, M.S. and Zaniewski, J.P., " *Materials for Civil and Construction Engineers* ", Prentice Hall Inc.
5. Deodhar, S.V. "*Construction Equipment and Job Planning* ", Khanna Publishers, New Delhi.
6. Dr. Mahesh Varma, "*Construction Equipment and its Planning and Application* ", Metro-politan Book Company, New Delhi
7. James, J.O Brien, "Construction Inspection Handbook - Quality Assurance and Quality Control ", Van Nostrand, New York.

Course plan

Module	Content	Hours	Semester Exam Marks (%)

I	**Modern Construction Materials:** Overview of Building materials–Study of Advance Building materials - Aluminum – Glass and Fabric – Advantages and Applications of Advance Building materials.	4	15
	Types of Finishing materials, Construction chemicals- Sealants – Grouts – Mortars – Admixtures and Adhesives.	4	
II	**Metals:** Types of metals – Properties – Applications – Types of Steels – Grades of Steel – Properties - Applications	4	15
	Special alloys of Steel : Water Jet Cut Stainless Steel – Mild Steel – Tension Rods – Cast Iron – Heat Treatment in Steel and Tendons	4	
First Internal Examination			
III	Concrete construction- batching, mixing, transport, placement, finishing, formwork, scaffolding. Steel construction- fabrication and erection	6	15
IV	**Construction Building Methods :** Prefabricated Buildings – Properties, Advantages, Limitations and Applications	6	15
Second Internal Examination			
V	**Construction Equipment's**: Fundamentals of Earthwork operations – Equipment's for Excavation, Dredging, Trenching, Drilling, Blasting – Equipment's for compaction and erection .Tunneling equipment's	8	20
VI	Concrete Pumps - Boom pump, Stationary Pump, Specialized usage pumps – Dewatering and Grouting ,Foundation and Pile Driving Equipment	5	
	Material Handling Equipment : Trucks and Hauling Equipment, Finishing Equipment –Conveyors – Fork lift and Portable Material handlers	3	
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6113	ADVANCED CONCRETE TECHNOLOGY	3-0-0-3	2015

Course Prerequisites

Basic knowledge of ingredients of concrete their properties and their influence for strength and performance of concrete at UG level

Course Objectives

- The course is designed to provide advanced level knowledge on properties of concrete and its performance based on the behavior of ingredients and environmental conditions.

Syllabus

Ready mix concrete, under water concreting, shotcrete, Temperature problems, High strength concrete, High performance concrete, Fiber reinforced concrete, Ferro cement, Light weight concrete, High density concrete, Durability, Test on Hardened concrete, NDT tests on concrete.

Expected Outcomes

The students are expected to select concrete mix based on the requirement of the structure and performance based on the environmental conditions.

References

1. Kumar Mehta.P., Paulo J.M. Monteiro., Concrete- Microstructure, Properties and Materials, Tata McGraw Hill.
2. Neville, A.M and J.J. Brooks., Concrete Technology, Prentice Hall.
3. Neville, A.M.., Properties of Concrete, Prentice Hall.
4. Zongjin Li, Advanced Concrete Technology, Wiley.
5. Gambhir, M.L., Concrete Technology - Theory and Practice, McGraw Hill Education (India) Private Limited.
6. Shetty, M.S., Concrete Technology, Chand & Co.
7. Santhakumar, A. R., Concrete Technology, Oxford University Press.

IS: 10262□2009, Recommended Guidelines for concrete Mix Design, Bureau of Indian Standard

COURSE PLAN

Module	Content	Hours	Semester Exam Marks (%)
I	**Ready mix concrete -** manufacture, transporting, placing, precautions and methods of purchase. Code recommendations	5	15
II	**Temperature problems** in concreting- Hot weather problems and hot weather concreting, large concrete masses, cold weather concreting, problems	5	15
	First Internal Examination		
III	**Fiber reinforced concrete** - Fibers types and properties, Behavior of FRC in compression, tension including pre-cracking stage and post-cracking stages.	7	15
IV	**Ferro cement** - materials, techniques of manufacture, properties and application, advantages.	7	15
	Second Internal Examination		
V	**Light weight concrete**- materials properties and types. Typical light weight concrete mix- High density concrete - materials, properties and applications. High performance concrete-methods of obtaining high performance concrete, factors controlling high performance materials, properties, applications	8	20
VI	Durability and impermeability- Cracking, carbonation, alkali-silica reaction, chemical attack-sulphate attack and chloride attack. Test on Hardened concrete-Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition. Compression, tension and flexure tests. NDT tests on concrete- concepts-Rebound hammer, pulse velocity methods.	10	20
	Total	42	
	Cluster Level End Semester Examination		

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6115	FORENSIC ENGINEERING	3-0-0-3	2015

Course Prerequisites

Basic knowledge of civil engineering at UG/PG Level.

Course Objectives

- To discuss the causes of damages observed in concrete and steel structures
- Know- how of repair and retrofitting

Syllabus

Failure of Structures: Causes of distress in structural members-Environmental Problems and natural Hazards. Causes of deterioration in concrete and steel structures. Preventive measures, Diagnosis and assessment of deterioration- Methods of repair of cracks-Repairing of corrosion damage of reinforced concrete. Modern techniques of Retrofitting. Strengthening by pre-stressing. Repair of steel structures

Expected Outcomes

Student develops the capability to identify reasons of distress in structures and suggest repair/ remedial measures

References

1. Sidney M Johnson, Deterioration, Maintenance and Repairs of Structures, McGraw Hill Book Company, New York
2. Dovkaminetzky, Design and Construction Failures, Galgotia Publication, New Delhi
3. Jacob Field and Kennenth L Carper, Structural Failures, Wiley Europe

Course Plan

Module	Content	Hours	Semester Exam Marks (%)
I	Failure of Structures: Review of the construction theory – performance problems – responsibility and accountability	5	15

	– causes of distress in structural members – design and material deficiencies – over loading. Environmental Problems and Natural Hazards		
II	Causes of deterioration in concrete and steel structures. Preventive measures, maintenance and inspection.	5	15
First Internal Examination			
III	Diagnosis and assessment of deterioration, visual inspection, non destructive tests, ultrasonic pulse velocity method, rebound hammer method, pull out tests, Windsor probe test, crack detection techniques, etc.	7	15
IV	Case studies on diagnosis of deterioration – single and multi-storey buildings – Fibre optic method for prediction of structural weakness. Effect of corrosive, chemical and marine environment – pollution and carbonation problems – durability of RCC structures – damage due to earthquakes and strengthening of buildings – provisions of BIS 1893 and 4326.	7	15
Second Internal Examination			
V	Methods of repair of cracks, repairing spalling and disintegration, repairing concrete floors and pavements. Repairing of corrosion damage of reinforced concrete. Repair of steel structures.	8	20
VI	Modern Techniques of Retrofitting. Structural first aid after a disaster – guniting, jacketing – use of chemicals in repair – application of polymers – ferrocement and fiber concretes as rehabilitation materials – strengthening by pre-stressing – case studies – bridges – water tanks – cooling towers – heritage buildings – high rise buildings.	10	20
	Total	42	
CLUSTER LEVEL END SEMESTER EXAMINATION			

Course No.	Course name	L-T-P-credits	Year of introduction
10CE6202	CONSTRUCTION PERSONNEL MANAGMENT	3-0-0-3	2015

Course objectives

The course is designed to provide students a strong background in familiarize with leadership, organization pattern ,human behaviour in organization

Syllabus

Leadership, Organization, Human Behaviour, Productivity of Human resources, Communication, Manpower

Expected outcome

The students are expected to apply the general principles of construction personnel management in the field of Construction economy by understanding the human behavior in the construction world.

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.

Course plan

Module	Contents	Hours	Sem. Exam marks
I	**Leadership**: Definition – leaders vs. managers – styles of leadership - Theories of leadership, Personality theories- behavioral theories – situational theories	7	15
II	**Organization:** Organization-Span of control-Organization charts-Staffing plan- **j**ob descriptions and organization structure and Human relations	6	15

FIRST INTERNAL EXAM			
III	**Human Behaviour:** Introduction to the Field Of Management-basic individual psychology-motivation-Motivation of individuals – theories of motivation - Maslow's theory –Herzberg's model – McClelland's three need model – Vroom's expectancy theory – McGregor's theory.	8	15
IV	**Productivity of Human resources**: Compensation-Wages and Salary, Employee Benefits, employee appraisal and assessment- Employee services- Safety and Health-Discipline and Discharge-Special human resource problems, Performance appraisal	8	15
SECOND INTERNAL EXAM			
`V	**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	7	20
VI	**Manpower:** Manpower Planning, Organizing, Staffing Recruitment-Selection, directing and Controlling-Personnel Principles-	6	20
	Total	42	
CLUSTER LEVEL END SEMESTER EXAMINATION			

Course No.	Course name	L-T-P-credits	Year of introduction
10CE6104	Finite Element Method	3-0-0-3	2015

Course objectives

•Provide the fundamental concepts of FEM and its applications in structural engineering..

Syllabus

Introduction - Boundary value problems - General procedure in Finite Element Method - Formulation techniques - Basic elements - Interpolation and shape functions - Isoparametric Formulation – coordinate mapping - Numerical Integration - Plain stress, plain strain, axisymmetric problems

Expected outcome

The students are expected to gain the fundamental ideas of finite element analysis and appreciate its advantages in solving structural engineering problems.

References:

1. Cook, R.D., et al, Concepts and Applications of Finite Element Analysis, John Wiley.
2. Desai, C.S., Elementary Finite Element Method, Prentice Hall of India.
3. Chandrupatla, T.R., and Belegundu, A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India.
4. Bathe, K.J., Finite Element Procedures in Engineering Analysis, Prentice Hall of India.
5. Gallaghar, R.H., Finite Element Analysis: Fundamentals, Prentice Hall Inc.
6. Rajasekaran, S., Finite Element Analysis in Engineering Design, Wheeler Pub.
7. Krishnamoorthy, C.S., Finite Element Analysis – Theory and Programming, Tata Mc Graw Hill.
8. Zienkiewicz, O.C., and Taylor, R.L., The Finite Element Method, Vol. I and II, Mc Graw Hill.
9. Bhatti, Asghar, Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations

Course plan

Module	Contents	Hours	Sem. Exam marks
I	Introduction - Boundary value problems Introduction to approximate numerical solutions for solving differential equations	7	15
II	Formulation techniques: Element equations using variational approach - Element equations using weighted	7	15

	residual approach		
FIRST INTERNAL EXAM			
III	Basic elements: Interpolation and shape functions - convergence requirements. CST, LST, bilinear rectangle elements – solid elements	7	15
IV	Isoparametric Formulation: coordinate mapping - One dimensional bar element Development of stiffness matrix for beam elements.	7	15
SECOND INTERNAL EXAM			
V	Two dimensional isoparametric elements - CST, LST, bilinear quadrilateral elements - Plain stress, plain strain problems Introduction to higher order elements	7	20
VI	Numerical Integration: Gauss quadrature Axisymmetric problems	7	20
	Total	42	
CLUSTER LEVEL END SEMESTER EXAMINATION			

Course No.	Course name	L-T-P-credits	Year of introduction
10CE6106	Analysis and Design of Earthquake Resistant Structures	3-0-0-3	3

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

Syllabus

Elements of earthquake engineering; Earthquake response spectrum; Earthquake effects on structures; Review of damages during past earthquakes; Earthquake resistant design of structures; Design philosophy and guidelines ; IS 1893 Codal provisions- Determination of lateral forces; IS 13920 Codal provisions- basic principles for design and reinforcement detailing for members and joints ; Methods for repair & rehabilitation of damaged structure; Disaster mitigation

Expected outcome

Students will be able to:

- Understand various aspects of earthquake engineering
- Capability for design and detailing of earthquake resistant structures
- Awareness of disaster management after earthquakes

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
5. Standards, New Delhi
6. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice- Hall of India, New Delhi.
7. Anil K Chopra, Dynamics of Structures, Prentice- Hall of India, New Delhi.
8. S. K. Duggal, Earthquake Resistant Design of Structures-Oxford University Press-2007

Course plan

Module	Contents	Hours	Sem. Exam marks
I	Elements of earthquake engineering: plate tectonics theory- seismic waves- earthquake intensity and magnitude- characteristics of ground motion - recording instruments - consequences of earthquake- seismic zoning.	7	15
II	Earthquake resistant design of structures: Design philosophy and guidelines –IS 1893 codal provisions;	7	15

	Determination of lateral forces- Seismic coefficient method of analysis – Dynamic analysis.		
FIRST INTERNAL EXAM			
III	Earthquake response spectrum - characteristics-design spectrum; Earthquake effects on structures: effect of architectural features and structural irregularities- review of damages during past earthquakes.	7	15
IV	Torsion in buildings - calculation of shear force; Stress-Strain behaviour of concrete and steel under cyclic loads- Effect of concrete confinement-Ductility of RC members- Modes of failure of beams and columns- Desirable collapse mechanisms -Capacity Design philosophy; IS 13920 Code provisions- basic principles for design and reinforcement detailing for members and joints.	7	15
SECOND INTERNAL EXAM			
V	Examples on design of RC beams and columns using IS 13920; Shear Walls – functions, modes of failure- Design Examples; Design of Chimneys.	8	20
VI	Methods for Repair and rehabilitation of damaged structures; Methods for disaster mitigation; Vulnerability assessment and seismic evaluation of structures – vulnerability reduction.	6	20
	Total	42	
CLUSTER LEVEL END SEMESTER EXAMINATION			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6208	**Mini Project**	0-0-4- 2	2015

Course Prerequisites: None

Course Objectives

- The student is expected to start the preliminary background studies towards the project by conducting a literature survey in the relevant field.
- Increasing the breadth of knowledge
- Enhancing the ability of identify the area of the work, familiarize with the design and analysis tools required for the work and plan the experimental platform

Syllabus

The student is expected to carry out a Mini Project in one of the innovative area in the field of structural engineering and construction management and related areas. Students have to register for the Mini Project and select a topic in consultation with any faculty member offering courses for the programme. The project work can be a design project, experimental project or field surveying on any of the topics of structural and construction management interest, industrial or construction site training. The students will present their project work before the Committee. Each student will prepare the project report and submit to the Department through the guide.. Grades will be awarded on the basis of quantum of the project and the presentation

Expected Outcomes :At the end of the course, the student will be able to

- Identify and chose appropriate topic of relevance.
- Assimilate literature on technical articles of specified topic and develop comprehension.
- Prepare technical report.
- Design, develop and deliver presentation on specified technical topic.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6212	**STRUCTURAL ENGINEERING LAB**	0-0-2- 1	2015

Course Prerequisites: None

Course Objectives

- Practical training for conducting experiments related to structural engineering.
- Capability to use software's for analysis, design and detailing and experimental data.

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 etc.
3. Design a concrete mixes as per Indian standards and experimental study the results of fresh and hardened concrete by casting and testing simple compression, tension and flexural members.
4. Study of instruments used for determining the durability of materials
5. Analysis, design and detailing of a high rise building with special emphasis to earthquake
6. Analysis, design and detailing of Steel Industrial Building / Steel Multi-storey building
7. Design of steel Bridge / storage structures / towers / ribbed floor slab systems

Recommended Packages:

- AutoCAD, Microstation, MS-Office, Matlab, Grapher / Sigmaplot
- Autocivil, Intergraph
- StaadPro, STRAP, SAP, ETABS

Students are encouraged to take up a min-project on any of the above listed areas and complete it within the semester

Expected Outcomes. After completion if this course

- Acquire capacity to organize experiments for project and thesis works.
- Ability to analytically study the experimental results.
- Ability to use the software package for Analysis, design and detailing of structures.

Assessment :

ii) Practical Records / outputs 40%

iii) Regular Class Viva-Voce 20%

iv) Final internal Test (Objective) 40%

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6214	ADVANCED CONSTRUCTION TECHNIQUES	3 - 0 - 0 - 3	2015

Course Prerequisites

Basic knowledge of Advanced Construction Techniques at UG Level.

Course Objectives

The course is designed to provide students a strong background about various construction equipments and the concept of advanced techniques adopted in construction.

Syllabus

Introduction to geotechnical materials, Equipments, Earth Work methods, Techniques for concreting, Erection techniques of tall structures, Laying operations for built up offshore system, Construction sequence and methods, Construction techniques for foundation.

Expected Outcomes

The students are expected to be familiar with advanced construction techniques and hence to apply it's general principles in the field of construction.

References

1. Peurifoy R L,Construction, Planning, Equipment and Methods,Tata McGraw-Hill.
2. Leonhard E. Bernold, Construction Equipment and Methods: Planning, Innovation, Safety,
   Wiley Global Education, 2013.
3. Michael John Tomlinson, R. Boorman, Foundation Design and Construction, Prentice Hall, 2001
4. R. Chudley, Roger Greeno, Advanced Construction Technology, Pearson Prentice Hall, 2006
5. Robertwade Brown, "Practical foundation engineering hand book", McGraw Hill Publications, 1995
6. Patrick Powers .J, "Construction Dewatering: New Methods and Applications", John Wiley Sons, 1992.
7. Jerry Irvine, "Advanced Construction Techniques", CA Rockers, 1984

Course plan

Module	Content	Hours	Semester Exam Marks (%)
I	Soil processing – Compaction and stabilization – Soil stabilization with lime – Cement-soil stabilization. Stabilizing vertical cuts and slopes	4	15

	Equipment's - Compacting equipment's, Scrapers, Dozers, Excavators, Trenching Machines	4	
II	**Earth Work methods -** Trenching – Excavations - Braced Excavations– Embankments perimeter trench, Raking struts, cofferdams , Diaphragm walls	5	15
	Tunneling techniques , laying of pipes	3	
First Internal Examination			
III	**Techniques for concreting**: Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections launching techniques –Slip form techniques- suspended form work	7	15
IV	**Laying operations for built up offshore system:** shoring for deep - well points – dewatering and stand by plant equipment for underground open excavation - Trenchless Technology.	7	15
Second Internal Examination			
V	**Construction sequence and methods of :**Bow string bridges, cable stayed bridges. Construction sequence and methods in domes. Vacuum dewatering of concrete flooring	6	20
VI	**Construction techniques for foundation**: Repair of raft foundations of slab-Edge method, interior slab heaving-. Technique for repairing Cracked or bulging walls.	6	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6216	BUILDING SERVICES	3-0-0- 3	2015

Course Prerequisites

None

Course Objectives

The course is designed to expose the students to the knowledge of water supply , sewage, orientation , vertical transportation and fire safety

Syllabus

Water supply, orientation and planning of residential building ,General building requirements for lightening and ventilation ,sewage system , vertical transportation , ventilation and air-conditioning , fire safety

Expected Outcomes

At the end of the course, the student will be able to Plan and design the building services

References

1. National Building Code(NBC) , IS Codes
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.Severns 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,.
6. Building construction, Arora and Bindra, Dhanpatrai &Sons,2012

Course plan

Module	Content	Hours	Semester Exam Marks (%)
I	**Water Supply :** Water quality, Purification and treatment-water supply systems-distribution systems in small towns -	3	15

	Types of pipes used- laying jointing, testing-testing for water tightness	4	
II	Orientation and Planning: Selection of site, Orientation of building, Design of residential buildings with particular reference to grouping and circulation	3	15
	General building requirements: Open spaces in and around buildings for lighting and ventilation, Minimum sizes and height of roofs, Rat and Termite proofing of buildings, Lightning protection of buildings.	5	
First Internal Examination			
III	**Sewage System-**Sanitation in buildings- -pipe systems-storm water drainage from buildings -septic and sewage treatment plant - collection, conveyance and disposal of town refuse systems	7	15
IV	Vertical transportation in buildings: Essential requirements and details of construction of stairs, lifts escalators and ramps.	6	15
Second Internal Examination			
V	**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 –	4	20
	air conditioning systems for different types of buildings - protection against fire to be caused by A.C. systems	3	
VI	**Safety Against fire in buildings**- Safety**-**Ability of systems to protect fire-Preventive systems in high rise buildings-Fire escape system design- safety regulations.	3	20
	NBC-planning considerations in buildings like Noncombustible 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.	4	
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6218	EXPERIMENTAL TECHNIQUE AND INSTRUMENTATION	3 - 0 - 0 - 3	2015

Course Objectives

To enable students to:

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

Syllabus

Generalised measuring system: Static & Dynamic Performance Characteristics; Errors in measurement; Measurement of Strain- Strain Gauge types- Electrical resistance strain gauges- circuits; Force & displacement transducers; Accelerometers; Two dimensional photo elasticity- Stressed model in Polariscopes; Non Destructive Testing Methods; Indicating & recording elements.

Expected Outcomes

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

References

1 A.k Tayal- Instrumentation and Mechanical Measurements- Galgotia Publications

2 Bently J P - Principles of Measurement Systems – Longman, 1995

3 Nakra B C &Chaudhry - Instrumentation Measurement & Analysis - Tata McGraw Hill, 2004

4 Adams L F - Engineering Measurements and Instrumentation – English University Press, 1975

5 Doebelin E O - Measurement Systems Application & Design - McGraw Hill, 2003

6 Dally J W & Riley W F – Experimental stress Analysis - McGraw Hill, 1991

7

Course plan

Module	Content	Hours	Semester Exam Marks (%)

I	Introduction to measuring system: Purpose, properties and components of an instrument system –Basic Characteristics of Measuring Device :Accuracy, Precision, Repeatability, Range, Static Sensitivity, Linearity, Drift; Errors in measurement- classification –causes.	8	15
II	Measurement of Strain: Strain Gauge Characteristics-Mechanical Strain Gauges-types-working, Electrical resistance strain gauges – principle , Strain analysis-Strain Gauge rosettes-	8	15
First Internal Examination			
III	Strain Gauge circuits –the Wheatstone bridge circuit- quarter bridge, half bridge and Full Bridge , Potentiometer circuits	6	15
IV	Transducers: classifications, Basic requirements of a Transducer Load cells - different types- Proving Ring Diaphragm pressure gauges. Measurement of displacement: Potentiometers –types	7	15
Second Internal Examination			
V	Linear variable differential transformer – principle and working. Measurement of acceleration: Accelerometers - Characteristics– types- design– calibration techniques.	6	20
VI	Non Destructive Testing Methods: Rebound hammer test, Pullout test;. Ultrasonic pulse velocity Test. Methods; Detection of embedded reinforcement ; Core test	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6222	CONSTRUCTION ECONOMICS AND FINANCE MANAGEMENT	3-0-0- 3	2015

Course Prerequisites

None

Course Objectives

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

Syllabus

Economics, production function, marginal productivity, Time value of Money, Project Cost management, cost related information collection, cost control, cost saving areas.- role Method of cost analysis ,Depreciation ,Accounts management, types of payment to contractors Inventory - Inventory Control, determining inventory level, Economic Order Quantity

Expected Outcomes

After completing the course

- Able to apply the productivity and time value of money in construction industry
- Able to identify and apply the resources in Construction organization. `
- Understand the importance of cost control and deprecation
- Understand the fundamental of construction accounting and payment
- Understand the concept inventory in construction

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.
5. Kumar Neeraj Jha , "construction Project Management ' perason

Course plan

Module	Content	Hours	Semester Exam Marks (%)
I	Economics-scope and contribution of Economics in Civil Engineering, production function – marginal productivity,	3	15
	Time value of Money – nominal and effective interest rates,	4	

	interest formula, uniformly varying rates of payments and returns.		
II	*Project Cost management*: resource planning, cost planning, cost budgeting	3	15
	Cost related information collection- labour cost-material cost-plant and equipment cost- subcontractors cost- consumable cost- overhead cost.	4	
First Internal Examination			
III	Objectives of cost control, cost saving areas.- role of consultant-, project engineer ,estimating and cost control	4	15
	Method of cost analysis ,operation research- characteristics-scope only	3	
IV	Depreciation -causes –objectives-factors, straight line method, declining –balance method, sum of year digit method, sinking funding method	8	15
Second Internal Examination			
V	Accounts management: meaning, characteristics of accounting, Branches of accounting, Objectives and users of accounting advantage and limitations of accounting,	3	20
	Brief outline of -Capital, cash book-Balance sheet- Profit and loss account, measurement book and contract bills, types of payment to contractors	3	
VI	Inventory - General Overview- classification – direct and indirect inventory -,Inventory Control, Inventory needs	3	20
	Determining inventory level, order quantity, lead-time, safety stock , Inventory cost , Economic Order Quantity	4	
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6116	COMPOSITE STRUCTURES	3-0-0-3	3

Course Objectives

To enable students to:

Composite materials are finding immense application in the field of aerospace, automobile and civil engineering presently due to its outstanding material capability. It is required for the present structural engineers to know the fundamentals of composite materials for designing composite structures in various fields.

Syllabus

Introduction to composites; Composite Fundamentals, Structural applications of Composite Materials; Manufacturing Processes. Mechanics of Composite Lamina; Failure theories. Micro Mechanical Behaviour of Composite Laminates - Classical Lamination Theory, stress-strain variation, In-plane forces, bending and twisting moments, special cases of laminate stiffness. Laminate strength analysis procedure, Failure envelopes,. Free-Edge Inter laminar Effects, Analysis of free edge interlaminar stresses, Effects of stacking sequence, Design guidelines. Bending and Buckling Laminated Beams and Plates.

Expected Outcomes

1. An ability to identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
2. A basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior.
3. An ability to predict the failure strength of a laminated composite plate.
4. An ability to use the ideas developed in the analysis of composites towards using composites in aerospace design.

References

1. Jones M. Roberts, Mechanics of Composite Materials, Taylor and Francis,1998
2. Reddy, J.N , Mechanics of Laminated Composite Plates: Theory and Analysis, CRC Press, 2003
3. Calcote, L. R., Analysis of Laminated Composite structures, Van Nostrand, 1969
4. Vinson, J. R. and Chou P, C., Composite materials and their use in Structures, Applied Science Publishers, Ltd. London, 1975
5. Agarwal, B.D. and Broutman, L. J., Analysis and performance of Fibre composites. 3rd Edn., Wiley, 1990

Course plan			
Module	**Content**	**Hours**	**Semester Exam Marks (%)**
I	Introduction. Composite Fundamentals: Definition of composites, Objectives, constituents and Classification of composites Structural applications of Composite Materials, Manufacturing Processes. Review of Basic Equations of Mechanics and Materials and Linear Elasticity in 3D and 2-D plane stress and plane strain	7	15
II	Number of elastic constants and reduction from 81 to 2 for different materials. Stress-Strain relations for a unidirectional and orthotropic lamina Effective Moduli of a continuous fibre-reinforced lamina - Models based on mechanics of materials, theory of elasticity. Failure of Continuous Fibre-reinforced orthotropic Lamina. Maximum stress/strain criteria, Tsai-Hill and Tsai-Wu criterion.	7	15
FIRST INTERNAL EXAM			
III	Micro mechanical behaviour of composite laminates - Classical Lamination Theory, stress-strain variation, In-plane forces, bending and twisting moments, special cases of laminate stiffness.	7	15
IV	Laminate strength analysis procedure, Failure envelopes, Progressive failure Analysis. Free-Edge Interlaminar Effects , Analysis of free edge interlaminar stresses, Effects of stacking sequence, Hygrothermal effects on material properties on response of composites .	7	15
SECOND INTERNAL EXAM			
V	Bending of Laminated Beams and Plates - Governing equations and boundary conditions, Solution techniques, deflection of composite beams and plates under transverse loads for different boundary conditions	7	20
VI	Buckling of laminated beams and plates under in-plane loads and under different boundary conditions.	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE6122	ADVANCED PRESTRESSED CONCRETE DESIGN	3-0-0-3	3

Course Objectives

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

Syllabus

Basic concepts and need of prestressing, types and systems of prestressing, Devices and materials used in prestressing, losses in prestressing. Analysis of members under flexure, shear and torsion, Design of axially loaded members, flexural members and design for shear and torsion. Detailing of reinforcement. Calculation of deflection and crack width, Design of end block, design of slabs. Analysis and design of continuous beams, Composite construction and partial prestressing Circular prestressing, Design of prestressed concrete bridge decks.

Expected Outcomes

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

References

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi.
2. Mallick S.K. and Gupta A.P., Prestressed Concrete, Oxford and IBH publishing Co. Pvt. Ltd.
3. Rajagopalan, N, Prestressed Concrete, Alpha Science.
4. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi.
5. Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay.
6. IS 1343: 2012 Indian Standard Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi.
7. IS 456: 2000 Indian Standard Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.

Course plan			
Module	**Content**	**Hours**	**Semester Exam Marks (%)**
I	Basic concepts and need of prestressing, types and systems of prestressing, Devices and materials used in prestressing, losses in prestressing.	7	15
II	Analysis of members under flexure, shear and torsion. Design of axially loaded members	7	15
FIRST INTERNAL EXAM			
III	Design of flexural members and design for shear and torsion. Detailing of reinforcement	7	15
IV	Calculation of deflection and crack width; Design of end block, design of slabs.	7	15
SECOND INTERNAL EXAM			
V	Analysis and design of continuous beams, Composite construction and partial prestressing	7	20
VI	Circular prestressing, Design of prestressed concrete bridge decks	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction	
10CE6124	ANALYSIS AND DESIGN OF SUBSTRUCTURES	3-0-0-3	3	2015

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

Syllabus

Soil-structure interaction, Contact pressure distribution, Selection of foundations, Design of foundations -spread footing, combined Footing and raft foundation. Pile foundation, Estimation of pile capacity, Design of pile cap. Retaining Walls-Different Types - Stability analysis and Design. Introduction to well foundations – Types, Sinking stresses in wells, Design of well cap, Well steining, well curb, cutting edge and bottom plug.

Expected Outcomes

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

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.
3. Bowles J.E., Foundation Analysis and Design (4th Ed.), McGraw Hill Book Company, NY.
4. Varghese P.C, Foundation Engineering, Prentice Hall India, New Delhi.

Course plan

Module	Content	Hours	Semester Exam Marks (%)
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.	7	15
II	Structural Design of Shallow Foundation- spread footing, combined Footing and raft foundation.	7	15

FIRST INTERNAL EXAM			
III	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	7	15
IV	Structural Design of Pile and pile cap	7	15
SECOND INTERNAL EXAM			
V	Retaining Walls-Types - Stability analysis of cantilever retaining walls against overturning and sliding-Bearing capacity considerations- Structural design of retaining walls	7	20
VI	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	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction	
10CE6126	HIGH RISE STRUCTURES	3-0-0-3	3	2015

Course Objectives

- Provide ideas of various structural forms and the concepts of behaviour of common high rise structures under gravity and lateral loading.

Syllabus

Introduction - Design Criteria, Design Philosophy – Loading - Gravity loading - Wind Loading - Earthquake loading - Structural forms: Rigid frame Structures - Approximate analysis - two cycle moment distribution - Portal method, Cantilever method - Braced frames - Approximate analysis of drift- Shear wall Structures - Coupled shear walls - Wall frame structures - Tubular structures - Core structures - Foundations for tall structures.

Expected Outcomes

- The students are expected to gain the fundamental ideas of structural systems for various combinations of gravity and horizontal loading considering their functional use and heights.

References

1. Taranath B.S., Structural Analysis and Design of Tall Building, McGraw Hill, 1988.
2. Dr. Y.P.Gupta, Editor. Proceedings National Seminar on High Rise Structures - Design and Construction practices for middle level cities Nov. 14 -16, 1995, New Age International Limited, Publishers, Madras -20.
3. Wilf gang Schuller, High Rise Building Structures, John Wiley and Sons, 1977.
4. Bryan stafford Smith, Alexcoull, Tall Building Structures , Analysis and Design, John Wiley and Sons, Inc., 1991.
5. T.Y.Lin, D.Stotes Burry, Structural Concepts and system for Architects and Engineers. John Wiley, 1988.
6. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1986.

Course plan

Module	Content	Hours	Semester Exam Marks (%)

I	Introduction - Definition of tall building - need for constructing tall building - Historic background - factors affecting growth. Design Criteria, Design Philosophy of High Rise structures	7	15
II	Loading: gravity loading - Dead and live load, live load reduction techniques - sequential loading, Impact loading Wind Loading, Analytical and wind tunnel experimental method, Earthquake loading-equivalent lateral force method, modal analysis	7	15
FIRST INTERNAL EXAM			
III	Structural forms: Rigid frame Structures- rigid frame behaviour –approximate determination of member forces under gravity loading - two cycle moment distribution Approximate determination of member forces under lateral loading: Portal method, Cantilever method	7	15
IV	Braced frames: Types of bracings - behaviour of braced bents Approximate analysis of drift	7	15
SECOND INTERNAL EXAM			
V	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	7	20
VI	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	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE7201	**SEMINAR-II**	0-0-2- 2	2015

Course Prerequisites: None

Course Objectives

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

Syllabus

The student is expected to present a seminar in one of the current topics in the field of specialization and related areas. Students have to register for the seminar and select a topic in consultation with any faculty member offering courses for the programme. Students are required to prepare a seminar report in the prescribed format given by the Department. The seminar shall be of 30minutes duration and give presentation to the Seminar Assessment Committee (SAC) in the presence of their classmates. It is mandatory for all the students to attend the presentations of their classmates. Seminar I and seminar II shall be offered in first and third semesters. Institutions can advise students belonging to about 50% of number of students in the SCM Stream to opt for Structural Engineering field in Semester 1 for the seminar topic and Construction management field in Semester 3 for the seminar topic and vice versa.

Expected Outcomes :At the end of the course, the student will be able to

- Identify and chose appropriate topic of relevance.
- Assimilate literature on technical articles of specified topic and develop comprehension.
- Prepare technical report.
- Design, develop and deliver presentation on specified technical topic.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE7203	**PROJECT PHASE -1**	0-0-12- 6	2015

Course Prerequisites: Both I & II Semester course work of I Year should be completed

Course Objectives

The main objective of the Master Research Project is to identify current issues in the area of structural engineering and Construction Management. The ability of the student to address contemporary issues and to find practical/ theoretical solutions to these issues based on scientific evidence /finding .Also, continued and self-learning skill of the student is enhanced.

Syllabus

Students are required to search, collect and review various research articles published in chosen area of research. A student has to select a topic for his dissertation, based on his/her interest and the available facilities at the commencement of dissertation work. A student shall be required to submit a interim dissertation report on the research work carried out by him/her.

The fourth semester Thesis-Final shall be an extension of this work in the same area

Expected Outcomes

At the end of the course, the student will be able to

- Define Research Problem Statement.
- Critically evaluate literature in chosen area of research & establish scope of work
- Develop study / experimental methodology
- Conduct Laboratory studies/theoretical study/experiment.

Course No.	Course name	L-T-P-credits	Year of introduction
10CE7205	PAVEMENT CONSTRUCTION PRACTICE	3- 0-0-3	2015

Course objectives

1. The course is designed to provide students a strong background in pavement construction, materials and machineries used for construction, as well as pavement evaluation.

Syllabus

Road pavement - functions and characteristics of pavement – types of pavement; Road making machineries; Construction Practice: components of flexible pavement; Bitumen: general properties – modifies binders ; Rigid Pavements: Introduction – Construction Practices ; Failure of Pavements: Evaluation of Pavement Surface Condition; Pavement Overlays & their design

Expected outcome

1. The students is expected to understand the properties and use of various materials and construction, , evaluation and maintenance of flexible and rigid pavements.

Reference

1. L R kadiyali and N B Lal, principles and practices of highway engineering.
2. S K Khanna and Justo, highway engineering.
3. Yoder and Witczak, 'Principles of Pavement Design', John Wiley,1975
4. Huang Yang H.,Pavement Analysis and Design, Pearson Education India, 2008
5. Nai C. Yang, 'Design of Functional Pavements', McGraw Hill ,1972
6. IRC: 37 -2001, 'Guidelines for the Design of Flexible Pavements'
7. IRC: 58 -2002, 'Guidelines for the Design of Rigid Pavements'
8. Hass and Hudson, 'Pavement Management System', McGraw Hill Book Co. ,1978
9. Mix Design Methods for Asphalt Concrete and other Hot mix types MS 2, Sixth Edition,TheAsphalt Institute, 1997
10. IRC 81-1981-'Tentative Guidelines for Strengthening of Flexible Pavements by BenklmanBeam Deflections Techniques'

Course plan

Module	Contents	Hours	Sem. Exam marks

I	**Road pavement:** functions and characteristics of pavement – types of pavement – flexible pavement – rigid pavement – comparison –	2	15
	factors affecting pavement design – pavement courses – granular sub bases, bases and surface courses – gravel courses – water bound macadam	3	
II	**Construction Practice:** components of flexible pavement - Base courses – Bituminous macadam – Dense bituminous macadam – bituminous concrete – Semi Dense Bituminous Concrete – Construction methods	4	15
	Marshall method of mix design for dense bituminous courses	2	
	Surface courses – Surface dressing, Premix carpet, Mix seal surfacing – Mastic asphalt - Construction methods – Quality Control measures	3	
FIRST INTERNAL EXAM			
III	**Machineries**: Road making machineries, paver – Road formation, bituminous constructions,	2	15
	road surface evaluation, compactor- Vibratory Steel Drum, Padded Drum, Pneumatic tire	3	
	Asphalt distributors, curb machine, Road reclaimers, Concrete and pavement plant	2	
IV	**Bitumen:** general properties – methods to improve bitumen quality – modifies binders – Polymer modified bitumen –	3	15
	Super pave concepts – Recycling of bituminous courses	3	
SECOND INTERNAL EXAM			
V	**Rigid Pavements:** Introduction – Construction Practices – Concrete Mix Design –	5	20
	Formwork Dewatering – Joints – Maintenance	3	
VI	**Failure of Pavements:** Evaluation of Pavement Surface Condition -	2	20
	Effect of Environment and Traffic on Structural Stability,	2	
	Pavement Deterioration - Evaluation of Pavement Structural Condition by Non-Destructive and Destructive Methods -	2	
	Pavement Overlays & their design	1	
	Total	42	
CLUSTER LEVEL END SEMESTER EXAM			

Course No.	Course name	L-T-P-credits	Year of introduction
10CE7207	QUANTITATIVE TECHNIQUES IN MANAGEMENT	3- 0-0-3	2015

Course objectives

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

Syllabus

concepts of probability and statistics , Operations research, Inventory control, Working Capital Management Decision Theory, Queuing theory

Expected outcome

At the end of the course, the student will be able to:

1. Formulate and solve deterministic optimization problems.
2. Plan and manage activities using queuing and Decision theory.

Reference

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.
6. Freund, J.E. and Miller, I.R., Probability and Statistics for Engineers, Prentice - Hall of India, 5th edition, New Delhi, 1994.
7. Goel B.S. and Mittal, S.K., Operations Research, Pragati Prakashan, Meerut, 2000.
8. Gupta, S.C. and Kapur, V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 1999
9. Taha, H.A.., Operations Research: An Introduction, Prentice - Hall of India, 8th Ed., New

Delhi, 2010.

Course plan

Module	Contents	Hours	Sem. Exam marks
I	Introduction and concepts of probability and statistics: Probability: Conditional probability,	2	15
	Probability distributions (Normal, Bayesian, Poisson, Exponential), Probability density functions	5	
II	**Introduction to Operations research:** Linear programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems	7	15
	FIRST INTERNAL EXAM		
III	Inventory control: EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM Simulation Models	7	15
IV	**Working Capital Management:** Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting.	7	15
	SECOND INTERNAL EXAM		
V	**Decision Theory:** Decision Rules-Decision making under conditions of certainty, risk and uncertainty-Decision trees-Utility Break-even -Analysis-Pricing techniques- Game Theory application	7	20
VI	Queuing theory: Single server infinite queue length model,Single server finite queue length model, multiple server infinite queue length model,multiple server infinite queue length model.	7	20
	Total	42	
	CLUSTER LEVEL END SEMESTER EXAM		

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10CE7209	DISASTER MANAGEMENT	3 - 0 - 0 - 3	2015

Course Prerequisites

Basic knowledge of various kinds of disasters and importance of disaster management at UG/PG Level.

Course Objectives

The course is designed to provide students strong background knowledge of Disaster Management.

Syllabus

Overview of Disaster Management, Disaster Management Cycle; Phase I: Mitigation, and strategies, hazard identification and vulnerability analysis, Phase II: Preparedness, Disaster Risk Reduction (DRR), Emergency Operation Plan (EOP), Phase III and IV: Response and recovery, Disaster Community: Community-based Initiatives in Disaster management, Disaster Planning: Disaster Response Personnel and duties, Hazardous Materials, Ways of storing and safely handling hazardous materials.

Expected Outcomes

The students are expected to have an understanding of the roles of the various phases of disaster management and the knowledge of mitigation planning and policy strategies.

Text books

1. Narayan, B. ,Disaster Management, New Delhi: A.P.H. Publishing Corporation ,2009
2. Kumar, N.. Disaster Management. New Delhi: Alfa Publications. ,2009
3. Ghosh, G. K., Disaster Management. New Delhi: A.P.H Publishing Corporation. ,2008

References

1. Ayaz,. Disaster Management: Through the New Millennium. , Anmol Publications. 2
2. Dave, P. K.. Emergency Medical Services and Disaster Management: A Holistic Approach. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2009
3. Goel, S. L., Disaster Management. New Delhi: Deep & Deep Publication Pvt. Ltd. ,2008
4. Singh, R. B., Disaster Management. New Delhi: Rawat Publications., 2008.

Course plan

Module	Content	Hours	Semester Exam Marks (%)
I	Overview of Disaster Management	3	15

	Distinguishing between an emergency and a disaster situation	3	
II	**Disaster Management Cycle:** Phase I: Mitigation, and strategies; hazard identification and vulnerability analysis, Disaster Mitigation and Infrastructure	4	15
	Impact of disasters on development programmes, vulnerabilities caused by development, developing a draft country level disaster and development policy	4	
First Internal Examination			
III	**Phase II:** Preparedness, Disaster Risk Reduction (DRR), Emergency Operation Plan (EOP), Mainstreaming Child Protection and Gender in Emergency Planning, Assessment.	5	15
IV	**Phases III and IV:** Response and recovery, Response aims, Response Activities, Modern and traditional responses to disasters, Disaster Recovery, and Plan	5	15
Second Internal Examination			
V	**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	6	20
	Methods of Dissemination of Information	2	
VI	**Disaster Planning:** Disaster Response Personnel and duties, Community Mitigation Goals, Pre- Disaster Mitigation Plan, Personnel Training, Volunteer Assistance, School-based Programmes	5	20
	Hazardous Materials, Ways of storing and safely handling hazardous materials, Coping with Exposure to Hazardous Materials	5	
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course name	L-T-P-credits	Year of introduction
10CE7211	SYSTEM INTEGRATION IN CONSTRUCTION	3-0-0-3	2015

Course objectives

The course is designed to provide a background knowldedge of integrating the various systems in construction and to introduce the idea of intelligent buildings and building management system.

Syllabus

Structural systems, systems for enclosing building, 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, Elevators, Escalators, Conveyors, Security Systems In Buildings. Design parameters for Determining the Loads & Requirement, Operation and Maintenance of These Services. Planning systems for least maintenance-Feasibility for replacement of damaged components -equal life elemental design- Maintenance free exposed and finished surfaces. Intelligent Buildings, Automation Of All The Services And Equipment, Building Management Systems (BMS and building controls

Expected outcome

The students are expected to understand general principles of HVAC system and applying Building Management System for design of intelligent buildings. `

Text books:

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

Course plan

Module	Contents	Hours	Sem. Exam

			marks
I	**Structural integration:** Structural systems, systems for enclosing building	3	15
	Functional aesthetic systems, material selection and specifications.	3	
II	**Environmental factors:** Environmental-Qualities of enclosure necessary to maintain a specified level of interior environmental quality-Weather Resistance-Thermal infiltration	3	15
	Acoustic control-Transmission reduction-Air quality-Illumination	2	
	Relevant Systems integration with structural systems	2	
FIRST INTERNAL EXAM			
III	**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	3	15
	Design parameters for Determining the Loads & Requirement	3	
	Operation and Maintenance of These Services	2	
IV	Component Longevity in terms of operation performance and resistance to deleterious forces-Planning systems for least maintenance	3	15
	Feasibility for replacement of damaged components -equal life elemental design	3	
	Maintenance free exposed and finished surfaces.	2	
SECOND INTERNAL EXAM			
`V	**Intelligent Buildings:** Concept-Purpose-Control Technologies	4	20
	Automation Of All The Services And Equipment	3	
VI	**Building Management Systems (BMS):** Commercial, Industrial, Institutional and Domestic Buildings-Energy Management Systems and Building controls	6	20
	Total	42	
CLUSTER LEVEL END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction	
10CE7105	DESIGN OF BRIDGES	3-0-0-3	3	2015

Course Objectives

To enable students to understand the theory and design methods of various forms of bridges.

Syllabus

Classification and components of bridge: road and railway bridge specifications, IRC provisions, Foundation and substructure: Analysis and Design of piers- Analysis and Design of abutments, bed blocks –Bearings-Design of R. C bridge slab –Design of T beam bridges-Design of Balanced cantilever bridges- Pre- stressed Concrete Bridges- Steel bridges-Composite bridges

Expected Outcomes

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

References

1. Johnson Victor D., Essentials of Bridge Engineering, Oxford & IBH Pub. Co.
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

Course plan

Module	Content	Hours	Semester Exam Marks (%)
I	Classification and components of bridge. Review of road and railway bridge specifications and IRC provisions. Foundation and substructure: Types of foundations, Piers - Forces on pier, Analysis and Design of piers.	7	15
II	Types of Abutments- Forces in abutments, Analysis and	7	15

	Design of abutments, bed blocks. Bearings: Concrete, steel and neoprene bearings, Design of elastomeric pad bearings.		
FIRST INTERNAL EXAM			
III	Design of R. C bridge – deck slab bridges (Culvert). Design of T beam bridges Grid analysis- Courbon's method-Orthotropic plate theory	7	15
IV	Design of Balanced cantilever bridge Introduction to – continuous girder bridges, box girder bridges, rigid frame bridges , arch bridges, Suspension bridge and Cable Stayed Bridge	7	15
SECOND INTERNAL EXAM			
V	Pre- stressed Concrete Bridges: Design of single span bridges-Introduction to various forms-Slab bridges-girder bridges-box girder bridges	7	20
VI	Steel bridges: Design of plate girder [bolted and welded connection] Design of Composite bridge (RCC slab over steel girder)	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction	
10CE7107	STRUCTURAL RELIABILITY	3-0-0-3	3	2015

Course Objectives

- Should be able to identify the uncertainty in structural systems
- Ability to extend reliability analysis concepts from structural elements to structural systems.

Syllabus

General introduction to structural safety and reliability, Concept of uncertainty in reliability based analysis and design. Random variables- Concept and definition, Probability axioms and probability functions, Conditional probability, Common probability density and distribution functions and its descriptors, Correlation between random variables. Joint probability distributions, Functions of random variables- Expectation and moments of functions of random variables. Concept of failure of a structure, Reduced variable space and basic definition of reliability index, First order second moment index, Hasofer-Lind reliability index, Rackwitz - Fiessler reliability index. Second order reliability method. System reliability, Simulation techniques in reliability estimation. Importance of sampling, Variation reduction techniques, Time variant reliability- (introduction alone)

Expected Outcomes

Students will be able to:

- Understand reliability concept and reliability indices
- Analyse structural systems using reliability method

References

1. Andrzej S. Nowak & Kevin R. Collins, Reliability of Structures, McGraw-Hill,1999.
2. Robert E. Melchers, Structural Reliability Analysis and Prediction, John Wiley & Sons,1999.
3. R. Ranganathan, Reliability Analysis and Design of Structures, Jaico Publishing House, Mumbai,1999.
4. Ang, A.H.S. and Tang, W.H. (1975). Probability Concepts in Engineering Planning and Design, Vol. 1, Basic Principles, John Wiley, New York,1975.
5. Ang, A.H.S. and Tang, W.H. (1984). Probability concepts in engineering planning and design. Volume II, John Wiley & Sons, Inc., New York, 1984.

Course plan

Module	Content	Hours	Semester Exam Marks (%)

I	General introduction to structural safety and reliability, Concept of uncertainty in reliability based analysis and design	7	15
II	Random variables- Concept and definition, Probability axioms and probability functions, Conditional probability, Common probability density and distribution functions and its descriptors, Correlation between random variables.	7	15
FIRST INTERNAL EXAM			
III	Joint probability distributions, Functions of random variables- Expectation and moments of functions of random variables.	7	15
IV	Concept of failure of a structure, Reduced variable space and basic definition of reliability index, First order second moment index, Hasofer-Lind reliability index, Rackwitz - Fiessler reliability index. Second order reliability method.	7	15
SECOND INTERNAL EXAM			
V	System reliability, Simulation techniques in reliability estimation	7	20
VI	Importance of sampling, Variation reduction techniques, Time variant reliability- (introduction alone)	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction	
10CE7111	STABILITY OF STRUCTURES	3-0-0-3	3	2015

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.

Syllabus

Buckling of Columns -Methods of Neutral Equilibrium, Large Deformation Theory for Columns, Energy method for calculating critical loads, Buckling of Built up Columns, Torsional Buckling, Buckling of Frames, Buckling of Plates, Instability of shells

Expected Outcomes

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

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

Course plan

Module	Content	Hours	Semester Exam Marks (%)
I	Introduction – Concepts of Stability instability and bifurcation, different forms of structural instability - Buckling of Columns – Methods of Neutral Equilibrium – Euler Column – Eigen Value Problem – Axially Loaded Column – Effective Length Concept and Design Curve	7	15

II	Large Deformation Theory for Columns. The Behaviour of Imperfect Columns. Eccentrically Loaded Column. Inelastic Buckling of Columns- Double Modulus Theory- Tangent Modulus Theory	7	15
FIRST INTERNAL EXAM			
III	Energy method for calculating critical loads – Rayleigh Ritz Method – Galerkin Method – Numerical Methods – Flexural Members and Compression Members	7	15
IV	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.	7	15
SECOND INTERNAL EXAM			
V	Torsional Buckling. Torsional and Torsional – Flexural Buckling of Columns, Lateral Buckling of Beams. Continuous beams with axial load. Buckling of Frames – Introduction – Modes of Buckling – Critical Load Using Neutral Equilibrium Methods.	7	20
VI	Buckling of Plates – Differential Equation of Plate Buckling – Critical Load of a plate uniformly compressed in one direction. Tension field behaviour in Plate Girder Webs Post-buckling behaviour of axially compressed plates. Instability of shells.	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction	
10CE7115	ADVANCED FINITE ELEMENT ANALYSIS	3-0-0-3	3	2015

Course Objectives

- Provides students advanced level knowledge in Finite Element methods. .

Syllabus

Plate Bending, Error Estimation and Convergence, Finite Elements in Structural Dynamics and Vibrations, Modelling Considerations and Software Use, Introduction to Nonlinear Problems, Stress Stiffening and Buckling

Expected Outcomes

- Students become aware of the various applications of Finite Element Methods in plates and shells , structural dynamics and linear and non-linear problems in structural engineering.

References

1. . Cook, R.D., et al, Concepts and Applications of Finite Element Analysis, Fourth Edition, John Wiley & Sons Inc., Singapore, 2003.
2. Desai, C.S., and Kundu, T., Introductory Finite Element Method, CRC Press, London, 2001
4. Bathe, K.J., Finite Element Procedures, Prentice Hall of India.
5. Zienkiewicz, O.C., and Taylor, R.L., The Finite Element Method, Vols. I and II, Mc Graw Hill.

Course plan

Module	Content	Hours	Semester Exam Marks (%)
I	Plate Bending: Plate behaviour, Kirchhoff and Mindlin plate elements, boundary conditions. Shells: Shells of revolution, general shells, three- and four-noded shell elements, curved isoparametric elements.	7	15
II	Error, Error Estimation and Convergence: Sources of error, ill-conditioning, condition number, diagonal decay test, discretisation error, multimesh extrapolation, mesh revision methods, gradient recovery and smoothing, a-posteriori error estimate, adaptive meshing.	7	15

	Constraints, Penalty Forms, Locking and Constraint Counting: Explicit constraints, transformation equations, Lagrange multipliers, penalty functions, implicit penalty constraints and locking, constraint counting, modelling incompressible solids..		
FIRST INTERNAL EXAM			
III	Finite Elements in Structural Dynamics and Vibrations: Dynamic equations, mass and damping matrices, consistent and lumped mass, natural frequencies and modes, reduction of the number of degrees of freedom, modal analysis, Ritz vectors, harmonic response, direct integration methods, explicit and implicit methods, stability and accuracy, analysis by response spectra	7	15
IV	Modelling Considerations and Software Use: Physical behaviour versus element behaviour, element shapes and interconnections, test CASs and pilot studies, material properties, loads and reactions, connections, boundary conditions, substructures, common mistakes, checking the model, critique of computed results	7	15
SECOND INTERNAL EXAM			
V	Introduction to Nonlinear Problems: Nonlinear problems and some solution methods, geometric and material nonlinearity, problems of gaps and contacts, geometric nonlinearity, modelling considerations.	7	20
VI	Stress Stiffening and Buckling: Stress stiffness matrices for beam, bar and plate elements, a general formulation for [ks], bifurcation buckling, remarks on [ks], its use, and on buckling and buckling analysis.	7	20
	Total	42	
Cluster Level End Semester Examination			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
10 CE7204	**PROJECT PHASE -II**	0-0-23- 12	2015

Course Prerequisites: completed Project Phase -1 in third semester

Course Objectives

The main objective of the Master Research Project is to identify current issues in the area of structural engineering and Construction Management. The ability of the student to address contemporary issues and to find practical/ theoretical solutions to these issues based on scientific evidence /finding .Also, continued and self-learning skill of the student is enhanced..

Syllabus

Students are required to search, collect and review various research articles published in chosen area of research. One technical paper is to be prepared for possible publication in journals / conferences. A student shall be required to submit dissertation report on the research work carried out by him/her and Present his Research work in front of Evaluation committee

Expected Outcomes

At the end of the course, the student will be able to

- Expand on the defined research problem in Project Phase-1.
- Conduct Laboratory studies/theoretical study/experiment.
- Analyze data, develop models and offer solutions