KERALA TECHNOLOGICAL UNIVERSITY

ERNAKULAM WEST (06) CLUSTER

DRAFT SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

STRUCTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT

(2015 ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN STRUCTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT

SEMESTER-1

Exam Slot	Course No:	Name	L- T– P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	06CE6017*	Advanced Structural Design	4-0-0	40	60	3	4
B	06CE6027*	Structural Dynamics	4-0-0	40	60	3	4
C	06CE6037**	Advanced Construction Management	4-0-0	40	60	3	4
D	06CE6047*	Numerical Methods in Civil Engineering	3-0-0	40	60	3	3
E	06CE6X57	Elective I	3-0-0	40	60	3	3
F	06CE6067***	Research Methodology	1-1-0	100	0	0	2
G	06CE6077	Seminar	0-0-2	100	0	0	2
H	06CE6087	Advanced Construction Planning Lab	0-0-2	100	0	0	1

Credits:23

	Elective I(06CE6X57)
06CE6157#	Advanced Concrete Technology
06CE6257##	Theory of Elasticity and Plasticity
06CE6357**	Construction Equipments & Management

* Common with CASE

**Common with CEAM

***Common with CASE, CEAM, ENVT, GMST

Common with CEAM, GMST

##Common with GMST

SEMESTER-II

Exam Slot	Course No:	Name	L-T– P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	06CE6018*	Finite Element Analysis	4-0-0	40	60	3	4
B	06CE6028	Construction planning, scheduling and control	3-0-0	40	60	3	3
C	06CE6038**	Prestressed Concrete Structures	3-0-0	40	60	3	3
D	06CE6X48	Elective II	3-0-0	40	60	3	3
E	06CE6X58	Elective III	3-0-0	40	60	3	3
F	06CE6068	Mini Project	0-0-4	100	0	0	2
G	06CE6078	Computer Aided Structural Analysis and Design Lab	0-0-2	100	0	0	1

Credits:19

Elective II - (06CE6X48)		**Elective III- (06CE6X58)**	
06CE6148**	Bridge Engineering	06CE6158	Microstructrures and Innovations in Structural Concrete
06CE6248	Matrix Methods of Structural Analysis	06CE6258	Repair and Maitenance of structures
06CE6348***	Analysis of Plates and Shells	06CE6358	Quantitative Techniques in Construction Management#

* Common with CASE

**Common with CASE, GMST

***Common with GMST

#Common with CEAM

SEMESTER-III

Exam Slot	Course No:	Name	L- T – P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	06CE7X17	Elective IV	3-0-0	40	60	3	3
B	06CE7X27	Elective V	3-0-0	40	60	3	3
	06CE7037	Seminar	0-0-2	100	0	0	2
	06CE7047	Research Project (Phase 1)	0-0-8	50	0	0	6

Credits: 14

Elective-IV(06CE7X17)		Elective-V(06CE7X27)	
06CE7117	Advanced Design of Steel Structures	06CE7127*	Quality Management and Safety in Construction Engineering
06CE7217	Stability of Structures	06CE7227	Construction Contracts and Legal Aspects
06CE7317	Advanced Foundation Engineering	06CE7327*	Disaster Management

*Common with CEAM

SEMESTER-IV

Exam Slot	Course No:	Name	L-T-P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
	06CE7018	Research Project (Phase 2)	0-0-21	70	30	0	12

Credits: 12

Total Credits for all semesters: 68

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6017	Advanced Structural Design*	4-0-0-4	2015
Pre-requisites	Basic concepts of analysis and design of structures		

Course Objectives

To instruct the students on

- The concept of yield line and its analysis in structures
- The design aspects for special RC elements
- Concept of earthquake resistant design of structures

Syllabus

Yield line method of analysis of slabs: Characteristic features of yield lines, Design of special RC elements: Design of shear walls (with and without boundary elements), Design of Deep beams, Design of continuous beams Design of flat slabs Concept of Earthquake Resistant Design: Concept of capacity design, Strong Column weak beam. Ductile design - detailing of beams and shear walls. Calculation of Base shear and its distribution by using codal provisions.

Course Outcome

On completion of the course the students shall attain knowledge on the fundamental concepts on the analysis of slabs by yield line theory & design of R.C structures like grid floors, flat slabs, deep beams etc. and also earthquake resistant design of structures and ductile detailing.

Textbooks

1. Krishna Raju N., "Advanced Reinforced Concrete Design", CBS Publishers and distributers, New Delhi
2. S. K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, New Delhi

References

1. P C Varghese, "Limit State Design of concrete structures".
2. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India Private Limited, New Delhi, India.

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I **Yield line method of analysis of slabs**:Characteristic features of yield lines– analysis by virtual work method – Yield line analysis by equilibrium method, Design of grid floor – Approximate method– Rigorous method (Concept only).	13	**25**
Module II **Design of special RC elements**: Design of shear walls (with and without boundary elements), Design of Deep beams, Design of continuous beams– Redistribution of moments. Design of flat slabs: – Introduction–components–IS Code recommendations– IS code method of design (with and without drop).	15	**25**
Module III **Concept of Earthquake Resistant Design:** Objectives, Design Philosophy, Limit states, Inertia forces in Structure. Response of Structures – Effect of deformations in structure, Lateral Strength, Stiffness, Damping and ductility. **Building Configurations:** Size of Building, Horizontal and Vertical layout, Vertical irregularities, Adjacency of Building, Open-ground storey and soft storey, short columns. Effect of shear wall on Buildings. **Torsion and Twists in Buildings:** Causes, Effects, Centre of mass and rigidity. , Effect of torsion, Torsionally coupled and uncoupled system, Lateral load distribution, Numerical example based on IS code recommendation.	15	**25**
Module IV **R.C.C for Earthquake Resistant Structures**: Concept of capacity design, Strong Column weak beam. Ductile design, detailing of beams and shear walls. Calculation of Base shear and its distribution by using codal provision. Detailing of columns and Beam joints. Performance of R.C.C. Building. **Ductiledetailing:-** Study of IS: 13920-1993. **Repair/Reduction of Earthquake Effects**: - Methods, Materials	13	**25**

and retrofitting techniques.- Base Isolation and dampers.		
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6027	**Structural Dynamics***	**4-0-0-4**	**2015**
Pre-requisites	Basic knowledge of Mechanics of Materials A slight insight into the concepts of vibrations		

Course Objectives

To provide an understanding of how structures vibrate under the influence of different types of dynamic loads.

Syllabus

Dynamic load - Degrees of freedom –Formulation of equations of motion - Natural frequency- -D' Alemberts Principle –Energy principle - Rayleigh's method − Principle of virtual displacements − Hamilton's principle.Single Degree of Freedom Systems - Undamped and damped free and forced vibrations − Vibration isolation − Transmissibility Response to periodic forces- Vibration measuring and absorbing equipments -Duhamel integral for undamped system-Response to impulsive loads– Earthquake excitation- Response history and construction of response spectra-Multiple Degrees of Freedom Systems and Continuous systems -Natural modes − orthogonality conditions − modal Analysis − free and harmonic vibration −Continuous systems- Mode superimposition method- Mode acceleration method Approximate methods Rayleigh's method − Dunkerley's method − Stodola's method − Rayleigh –Ritz method − Matrix method.

Course Outcome

On successful completion of the course the students will be able to

Convert any structural system into its equivalent mechanical system
Formulate and solve the equation of notion and calculate the structural response
Determine the natural frequency by means of analytical and approximate methods

Textbooks

Clough & Penzien, "Dynamics of Structures".

M.Mukhopadhyay , "Vibrations, Dynamics & Structural systems".

References

Timoshenko, "Vibration Problems in Engineering".

Anil K Chopra, "Dynamics of structures", Pearson Education

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I Introduction: Dynamic load - Types of dynamic loading– Significance of structural dynamics in civil engineering practice - Degrees of freedom –Equivalent mechanical systems –Formulation of equations of motion - Natural frequency- Determination of natural frequency-D' Alemberts Principle –Energy principle - Rayleigh's method − Principle of virtual displacements − Hamilton's principle.	10	**20**
Module II Single Degree of Freedom Systems: Undamped and damped free and forced vibrations − Critical damping − Over damping − Under damping − Logarithmic decrement –Energy dissipated in damping- Coulomb damping - Response to harmonic loading − Evaluation of damping − Vibration isolation − Transmissibility Response to periodic forces- Vibration measuring and absorbing equipments - Duhamel integral for undamped system-Response to impulsive loads–Earthquake excitation- Response history and construction of response spectra-Response spectrum characteristics-Base excited systems	16	**30**
Module III Multiple Degrees of Freedom Systems and Continuous systems: MDF sytems - Natural modes − orthogonality conditions − modal Analysis − free and harmonic vibration −Continuous systems- Free longitudinal vibration of bars − Flexural vibration of beams with different end conditions − Forced vibration - Mode superimposition method- Mode acceleration method	16	**25**
Module IV Approximate methods: Rayleigh's method − Dunkerley's method – Stodola's method −Rayleigh –Ritz method − Matrix method.	14	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6037	Advanced Construction Management**	4-0-0-4	2015
Pre-requisites	Nil		

Course Objectives

- To impart knowledge on basic principle of management and construction organization.
- To enable students to apply techniques of project planning, scheduling and control.
- To provide knowledge on construction cost control and construction project economics
- To impart knowledge on construction, resource management

Syllabus

Scientific Management and MIS-Basic principles of management with special reference to construction industry-Management information systems - Network Construction in Techniques- network diagram -scheduling- Engineering Economics-Cash flow -benefit cost analysis -Resource Management-Personnel management-resource management.

Course Outcome

Students will acquire knowledge on basic principles of management about various project management techniques for the completion of construction projects.

Textbooks

1. Stevens JD, Techniques for construction network scheduling, Mc Graw Hill publishing Company
2. R.L. Purifoy-Construction planning Equipment and methods.
3. J.A. Havers-Hand book of heavy construction.
4. Prassanna Chandra. "Projects-Planning, Analysis, Selection, Financing, Implementation and Review" -Tata McGraw-Hill Education private limited.
5. R Paneerselvam. “Engineering Economics” - PHI Learning Private Limited, New Delhi.

References

1. B L Gupta & Amit Gupta. "Construction management and machinery" - Standard publishers Distributors, Delhi.
2. P. Gopalakrishnan & M. Sundaresan – Materials Management an integrated approach.
3. Louis A Allen – Management and organization
4. H.N.Ahuja –Construction performance control by network

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I Scientific Management and MIS Concept – Elements - Contributions of pioneers in scientific Management - Basic principles of management with special reference to construction industry. Management information systems – definition – evolution – organizational theory – systems approach – database management – information systems for decision making - MIS effectiveness and efficiency criteria	10	**25**
Module II Network Construction in Techniques Introduction – planning – work scheduling – work break down structure - network diagram – PERT/CPM techniques – precedence networks – least cost scheduling – resource allocation – updating – application of network techniques – related problems.	12	**25**
Module III Engineering Economics Cash flow – interest formulas and applications – time value of money – bases of comparison – decision making amongst alternatives – rate of return – replacement analysis – break even analysis – incremental analysis – benefit cost analysis - problems and case studies.	12	**25**
Module IV Resource Management Personnel management: Personnel principles – Organization - principles of organization - construction organization setup - plan of control-organization charts - managerial staffing-recruitment-selection-placement, training and development. Resource management: Basic concept – Labour requirements – Labour productivity – site productivity – Equipment Management – Material management.	12	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6047	Numerical Methods in Civil Engineering*	3-0-0-3	2015
Pre-requisites	**Nil**		

Course Objectives

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

Syllabus

Systems of Linear Equations: Gaussian Elimination - Factorisation - Cholesky's Method. Systems of Non- linear equations:Newton Raphson Method- Newton's Modified Method. Finite difference methods.Initial and Boundary value problems .Eigen value Problems.Numerical Integration.Interpolation: Lagrange – Hermitian and cubic spline methods.Numerical Solution of Partial differential equations: Classification of second order equations – finite difference approximation to partial derivatives – Solution of Laplace equation and solution of wave equation.

Course Outcome

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

Textbooks

1. Krishna Raju N and Muthu K.U "Numerical Methods for Engineering Problems" Maemillan India Limited
2. Grewal B. S, "Numerical Methods in Engineering and Science", Khanna Publications.

References

1. Rajasekaran. S, "Numerical Methods in Science and Engineering – A practical approach", A.H Wheeler & Co.
2. Stanton R.C, "Numerical Methods for Science and Engineering", Prentice Hall of India.
3. Smith G.D "Numerical Solutions for Differential equation".

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I **Systems of Linear Equations**: Gaussian Elimination - Factorisation - Cholesky's Method Systems of Non- linear equations: Newton Raphson Method- Newton's Modified Method	10	**25**
Module II **Finite difference methods:** Forward, Central and Backward differences. Initial and Boundary value problems – statically determinate and indeterminate beam problems- Buckling of columns. **Eigen value Problems**: Power method – Jacobi method	12	**25**
Module III **Numerical Integration:** Trapezoidal and Simpson's Rules - Gaussian quadrature formula – New mark's Method **Interpolation:** Lagrange – Hermitian and cubic spline methods.	10	**25**
Module IV **Numerical Solution of Partial differential equations:** Classification of second order equations – finite difference approximation to partial derivatives – Solution of Laplace equation and solution of wave equation.	10	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6157	Advanced Concrete Technology#	3-0-0-3	2015
Pre-requisites	Basic understanding of concrete properties and properties of concrete making materials.		

Course Objectives

- To impart knowledge of cement hydration and its microstructure.
- To impart knowledge on how to use various chemical admixtures and mineral additives to design various types of concrete.
- To understand the properties of various special concrete and its application.
- To understand the mix design of concrete.

Syllabus

Concrete materials, Admixture in concrete, Performance of concrete, Special concretes Durability of concrete, Mix design.

Course Outcome

On completion of the course, the students shall attain knowledge on the fundamental concepts of cement hydration and its microstructure. The student shall acquire knowledge of various admixtures used in concrete and how to use it.. The student will be able to design mix proportion of concrete.

Textbooks

1. Metha, P.K. and Monteiro, P.J.M, "Concrete, Microstructure, Properties and Materials", Fourth Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006.
2. Gambhir, M.L., "Concrete Technology", Third edition, Tata McGraw-Hill Education, 2004.
3. Santhakumar, A.R., "Concrete Technology", First edition, Oxford University Press India, 2006.

Note: Relevant IS codes are permitted for examinations

References

1. Neville, A.M. and Brooks, J.J., "Concrete Technology", Pearson Education India, 2008
2. IS 10262-2009, Recommended guidelines for concrete mix design.

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I Concrete materials: Chemical Composition of OPC -- Hydration process of Portland cement - Structure of hydrated cement paste - Interfacial transition zone – Significance of interfacial transition zone –special cements – Testing of cement and aggregates-requirements and quality of water for concreting.	13	**25**
Module II Admixture in concrete: Supplementary cementitious materials (SCM) – Silica fume – Fly ash – Ground granulated slag – Rice husk ash – metakaolin – Chemical admixtures – Normal water reducers and high range water reducers – Air entraining admixtures – Miscellaneous admixtures. Performance of concrete: Properties of fresh concrete and hardened concrete - Strength –Elastic properties - Shrinkage - Creep – Rheological behavior of fresh concrete – Modified slump test.	15	**25**
Module III Special concretes: Structural light weight concrete – applications - High strength concrete – significance, materials used - Self compacting concrete – significance, materials used and testing of SCC – Fiber reinforced concrete – mechanics of fiber pull out – toughening and strengthening mechanism - application of FRC – Concrete containing polymers – polymer concrete – latex modified concrete – polymer impregnated concrete – applications - Roller compacted concrete. Special concreting methods: General method of transporting concrete – Concrete pumping- Methods of curing and compaction - Vacuum dewatering process - Extreme weather concreting - Underwater concreting.	12	**25**
Module IV Durability of concrete: Sulphate attack – Alkali aggregate reaction – Effect of fire on concrete - - Corrosion of steel in concrete – Control of corrosion.	14	**25**

Mix design: Factors affecting mix proportion –Variability of concrete strength – Statistical quality control – Sampling and acceptance criteria – Mix design of normal strength concrete by BIS 10262:2009 – Basic considerations in the mix proportioning of high strength concrete, fiber reinforced concrete and self compacting concrete.		
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6257	Theory of Elasticity and Plasticity##	3-0-0-3	2015
Pre-requisites	Basic understanding of solid mechanics		

Course Objectives

- To enable the students to learn
- The fundamentals of stress, strain and displacement relationships, constitutional law, material characterization and Lami's parameters.
- Equilibrium equations, compatibility equations, stress functions, solution of two dimensional problems in Cartesian and polar coordinates.
- Torsion of circular bars.
- Fundamentals of Engineering Theory of Plasticity

Syllabus

Concept of Stress at a point. Strain and displacement. Constitutive equations Generalized Hooke's law. Equations of equilibrium. Compatibility equations. Stress functions. Two dimensional problems in Cartesian and Polar coordinates. Axis symmetrical problems and their solutions. Torsion of non circular bars. Saint Venant's method. Multi cellular sections. Shear flow. Membrane analogy. Enginering theory of plasticity**.** Levy-Misces and Prandtl-Rauss equations. flow rule. Mohr – Coulomb yield criterion for concrete. Yield surface in 3 D space of Principal stresses- Testing of concrete stress strain curve. Flow rule.

Course Outcome

On successful completion of the course one will be able to apply the principles of theory of elasticity to find solutions to the engineering problems related to the analysis and design of engineering structures and components. The determination of stress distributions will enable him to design satisfactorily the components.
A student will also be able to use the principles of plasticity to be applied to solve simple problems and to design components.

Textbooks

1. Timoshenko S P and Goodier J. N, "Theory of Elasticity", Tata Mcgraw Hill International Student Edition.
2. Srinath L. S, "Advanced mechanics of solids", Tata McGraw– Hill Publishing Company Ltd., New Delhi**.**

References

1. Akhtar Khan, Sujian Huang "Continuum Theory of Plasticity", Wiley Publications.
2. Wai-Fah Chen, "Plasticity in reinforced concrete", J-Ross Publishing

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I **Theory of Elasticity:** Introduction to ToE-Equilibrium of a body subjected to forces-Continuum-Stress at a point-Stress Tensor-Stress matrix-Notations-Sign Conventions-Traction Vector on an oblique plane with arbitrary orientation-Stress Transformation rule-Normal Stress and Shear stresses on any plane- Principal Stresses and their directions-Stress invariants-Octahedral normal and shear stresses-Spherical and deviatoric stresses-Stress ellipsoid-Cauchy's stress quadric-One sheeted and two sheeted hyperboloids-Transformation equations in two and three dimensions-Mohr's Circle representations-Equilibrium equations(2D and 3D). Introduction to strain-Kinematic or strain displacement equations-Normal strain-Shearing strain-Strain matrix formulation-Displacement components and strain-Pure deformation-Rotation in three dimensions-Principal strains-Strain along a line in terms of components of strain-Strain and rotation rates-Strain transformation rule(3D and 2D Cases)-Strain compatibility equations-physical meaning-Strain measurement-Rosette analysis-Rectangular, Star, Delta rosettes. Material characterization-Typical uniaxial stress strain curve for steel and concrete -Conventional and true values-Generalized Hooke's law-Anisotropic materials-Materials with elastic symmetries-Orthotropic and isotropic cases-Homogeneous materials-Lami's constants -Hooke's law for linear elastic isotropic solids..	18	**25**
Module II **Two dimensional stress–strain problems in elasticity:** Formulation and method of solutions-Plane stress and plane strain problems–Equations of compatibility in stress- Airy's stress function-Boundary conditions-Polynomial solutions-Examples of loaded beams-2D problems in polar coordinates-Axis symmetrical problems-Stress distribution in a hollow cylinder subjected to	10	**25**

uniform internal and external pressures-Pure bending of curved bars-Strain components in polar coordinates-Rotating discs-stress components-effects of circular hole on stress distribution of plates-Concentrated force on a straight boundary-Stress function and stress components.		
Module III **Torsion of non-circular straight bars:** Saint Venant's semi inverse method-Assumed displacements-Warping function-Components of stress-Conditions satisfied by warping functions-Determination of stress function and its properties along the boundary of the cross section-Shearing stresses give torque-Solution for elliptic cross section and equilateral triangular cross section-Comparison of a closed tubular section and Slit tubular cross section-Multi cellular sections-Shear flow-Shear stresses-Torque-Membrane analogy and its applications to solution of torsional problems-Stress function contours and warping displacement contours for elliptical and triangular cross sections-Hollow thin walled sections-Shear stress, torque and angle of twist-Very thin rectangular sections-Stress function-Shear Stress-Torque for a composite section.	12	**25**
Module IV **Engineering theory of plasticity:** Introduction-foundation of plasticity-the criterion of yielding-representation in the principal stress space-the deviatoric stress vector-Tresca and Misces criterion-Plane stress yield locus-Strain hardening postulates-Rule of plastic flow-Plastic potential-Plastic flow rule in the deviatoric plane-Associated flow rule-Stress increment and strain increment vector for a given state of stress-Regular yield surface- singular yield surface-constitutive equations. Levy-Misces and Prandtl-Rauss equations-Geometrical representations for work hardening material-Tresca's associated flow rule-Plastic strain increment vector associated with the Tresca and Misces criteria-Anisotropic flow rule-Uniaxial stress strain cycles in a cyclic hardening material.	16	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6357	CONSTRUCTION EQUIPMENTS AND MANAGEMENT**	3-0-0-3	2015
Pre-requisites	Nil		

Course Objectives

To give an idea about the different types of equipments used for various construction activities; their applications in construction projects and the efficient utilization of the same using some scientific principles.

Syllabus

Equipment cost analysis, Tractors, Bulldozers , Scrapers, Cranes, Excavating equipment, Clamshells, Trucks and wagons, Loaders, Hydraulic excavator, ripper, Engineering fundamentals of moving earth.

Course Outcome

At the end of this course students will be able to understand various types of equipments used in the constructions projects. Also students will learn the strategies and techniques of planning, selecting and other aspects of managing various construction equipments.

Textbooks

1. Peurifoy RL, Ledbetter WB, Schexnayder CJ, Construction planning, equipment and methods, McGraw Hill International editions
2. J.A.Havers - Handbook of Heavy constructions

References

1. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 1988.
2. Peurifoy RL, Ledbetter WB, Schexnayder CJ, Construction planning, equipment and methods, McGraw Hill International editions

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I Equipment cost analysis: ownership cost – depreciation accounting	8	25

– operation cost – economic life of construction equipment – equipment replacement calculations Engineering fundamentals of moving earth: material properties – payload – haul route – rolling resistance – influence factors – drawbar pull – rimpull – power output and torque – performance chart		
Module II Tractors and related equipment: tractor uses – type – performance characteristics of tractors; Bulldozers – blades – bulldozer production estimating; Clearing land: land clearing operations – types of equipment used – clearing techniques – land clearing production estimating – land clearing production study. Ripping rock: rippability of rock – speed of sound waves in rock – ripper attachments – economy of ripping – estimating ripping production.	8	**25**
Module III Scrapers: scraper types – scraper operation – scraper performance chart – cycle time of scraper – operating efficiency and production – push tractors required – increasing scraper production – scraper load growth curve – rolling resistance and scraper production – scraper performance calculation Cranes: crawler cranes – hydraulic truck cranes – all-terrain truck cranes – heavy lift crane – modified crane for heavy lift – tower cranes – crane booms – lifting capacities of crane – rated loads – rated loads for hydraulic cranes – rated loads for tower cranes – working ranges of cranes	10	**25**
Module IV Excavating equipment: Dragline: types – size – parts and operation – output – optimum depth of cut – effect of depth of cut and swing angle on dragline output – effect of bucket size and boom length on dragline production – effect of material class on cost of excavating; Clamshells: buckets – production rates of clamshell; Hydraulic	16	**25**

excavator: front shovels – size – parts and operation – selection – shovel production – effect of angle of swing on shovel production – production efficiency factor – hoes – basic parts and operation of a hoe – bucket rating for hydraulic hoes – hoe operating efficiency – hoe operating efficiency and production – gradalls. Loaders: types and sizes – bucket rating for loaders – operating specifications – production rates for wheel loaders – production rates for track loaders. Trucks and wagons: trucks – rear dump trucks – bottom dump wagons – capabilities for truck and wagons – balancing capacities of hauling units with excavator size – factors influencing the cost of hauling.		
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6067	RESEARCH METHODOLOGY***	1-1-0-2	2015
Pre-requisites	Nil		

Course Objectives

To teach and make the student aware about the methodology and techniques of doing research both in technology as well as in social sciences.

Syllabus

Objectives and types of research, research methods vs methodology, Different types of research, Research design and execution, Execution of the research, data collection and analysis, Reporting and thesis writing.

Course Outcome

On successful completion of the course the students will be equipped to carry out their research and emanate its outcomes to the outside world.

Textbooks

1. Kothari C.R., Research Methodology, New Age International Publishing.
2. Sam Daniel P. and Aroma G. Sam, Research Methodology, Gyan Publishing House

References

1. Panneerselvam R., Research Methodology, PHI Learning Pvt. Ltd.
2. Bhattacharyya D.K., Research Methodology, Excel Books India.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I Objectives and types of research, research methods vs methodology; Different types of research, Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, Literature review - primary and secondary data/information sources, reviews, monographs, patents, discussion series, white papers, research databases like CMIE, BB, UNSD etc., critical literature	7	25

review, identifying gap areas from literature review.		
Module II Research design and execution: Research design – basic principles, need of research design, features of good design, important concepts relating to research design, observation and facts, laws and theories, prediction and explanation, development of models	7	**25**
Module III Execution of the research, data collection and analysis: Aspects of method validation, observation and collection of data, methods of data collection, different sampling methods, data analysis techniques of hypothesis testing, ANOVA, randomized block design (RBD) and completely randomized design (CRD).	7	**25**
Module IV Reporting and thesis writing: Structure and components of scientific reports, types of report, technical reports and thesis. Different steps in thesis writing, layout, structure and language of typical reports, bibliography, referencing and footnotes. Research ethics – ethical issues, ethical committees, Scholarly publishing – design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.	7	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6077	**SEMINAR – I**	**0-0-2-2**	**2015**
Pre-requisites	**Nil**		

Course Objectives

To enable the students to

- refer national & international journals
- interpret the data available and present the same in a systematic manner.

Syllabus

Students have to register for the seminar and select a topic in consultation with any faculty member offering courses for the programme. The paper should be a detailed study on a recent advancement/trend in the field of structural engineering or construction management. A detailed write-up on the topic of the seminar is to be prepared in the prescribed format given by the Department. The seminar shall be of 30 minutes duration and a committee with the Head of the department as the chairman and two faculty members from the department as members shall evaluate the seminar based on the coverage of the topic, presentation and ability to answer the questions put forward by the committee.

Course Outcome

The student will be able to present the seminar in a befitting manner and answer to the queries regarding the selected topic.

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6087	**ADVANCED CONSTRUCTION PLANNING LAB**	**0-0-2-1**	**2015**
Pre-requisites	**Nil**		

Course Objectives

This course is designed to give the students an exposure to the utilization of sophisticated software for the development of plan, schedule, design and modelling of any civil engineering project.

Syllabus

Project management using CPM/PERT Software – PRIMAVERA & MS Project/Project Libre

Practice on the GUI of the software and Input of Date.

Practice on Creating Bar Charts/Grant charts.

Practice on creating CPM/PERT charts and finding out critical path.

Practice on resource allocation and leveling of resources.

Practice on Project Monitoring (Cost &Time).

Plotting and printing of various charts and project.

Filters and layouts- formatting the display- printing and reports.

Tracking progress- scheduling options and out of sequence progress.

Note:

The students must practice the application of both project management softwares in civil engineering projects.

Course Outcome

The student shall be able to plan and schedule any civil engineering project using software.

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6018	**FINITE ELEMENT ANALYSIS***	**4-0-0-4**	**2015**
Pre-requisites	**Nil**		

Course Objectives

To familiarize the students on

The concept of Basics of finite element method (FEM), Idealization of structures and general procedure of FEA
Finite Element modeling of one and two dimensional problems.
Applications of FEM in analysis of trusses Continuous Beam ,Plane Frames etc.

Syllabus

Introduction to FEM - Basic Equations of Solid Mechanics - Different approaches of FEM, Variational principles weighted residual approach and method of virtual work Basics of finite element method (FEM), Idealization of structures -Mathematical model - General procedure of FEA- Shape functions – Lagrange and serendipity elements, Isoparametric elements-Polynomials - Lagrangian and Hermition Interpolation - Convergence criteria - Conforming & nonconforming elements – Patch test. Stiffness matrix - Bar element - Beam element - Plane stress and plane strain and axisymmetric problems static condensation - Isoparametric elements - Numerical Integration.- Gauss-Quadrature ,Analysis of trusses, Finite Element Analysis of Continuous Beam ,Plane Frame Analysis,Analysis of Grid and Space Frame , Introduction to plate and shell elements

Course Outcome

On completion of the course the students shall attain knowledge on the fundamental finite element method (FEM), general procedure, development of stiffness matrices etc.The students shall gain ample knowledge on Finite Element Analysis of Continuous Beam ,Plane Frame Analysis,Analysis of Grid and Space Frame ,plate and shell elements etc.

Textbooks

1. C Zienkiewicz,."Finite Element Method", fifth Edition,McGraw Hill, 2002
2. R.D.Cook, "Concepts and Applications of Finite Element Analysis", John Wiley & Sons 9

References

1. C.S.Krishnamoorthy, "Finite Element Analysis",Tata McGraw Hill .New Delhi,1987.
2. S.Rajasekharan, "Finite Element Analysis in Engineering Design", S Chand & Co. Ltd.1999

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I **Introduction to FEM** - Basic Equations of Solid Mechanics - Review of equilibrium conditions, Strain-displacement relations, Stress - Strain relations, Plane stress and plane Strain problems, Different approaches of FEM, Direct method, Energy approach, Weighted residual Method; Variational principles weighted residual approach and method of virtual work. Derivation of equilibrium equations. Basics of finite element method (FEM), Idealization of structures -Mathematical model - General procedure of FEA	15	**25**
Module II **Shape functions** – Lagrange and serendipity elements, Element properties. Finite Element modeling of one and two dimensional problems. Isoparametric elements, four node, eight node elements. Polynomials - Lagrangian and Hermition Interpolation – Generalised coordinates – Natural coordinates - Compatibility - C0 and C1 elements - Convergence criteria - Conforming & nonconforming elements – Patch test.	15	**25**
Module III **Stiffness matrix** - Bar element - Beam element - Plane stress and plane strain and axisymmetric problems -Triangular elements - Constant Strain Triangle - Linear Strain Triangle – Legrangian and Serendipity elements, static condensation - **Isoparametric elements** - Numerical Integration.- Gauss- Quadrature .	12	**25**
Module IV Applications of FEM ,Analysis of trusses, Finite Element Analysis of Continuous Beam ,Plane Frame Analysis,Analysis of Grid and Space Frame , Introduction to plate and shell elements-FEM for thin and thick Plates – Shells.	14	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6028	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL	3-0-0-3	2015
Pre-requisites	Basic knowledge in construction procedures		

Course Objectives

- To learn the basic concepts of planning and control processes of construction projects.
- To learn scheduling methods for project management.
- To obtain the knowledge of integrating time with cost.
- To understand theories behind optimal resource allocation and leveling

Syllabus

Construction Plans - Work Tasks - Construction Scheduling – Resource orientated scheduling - Monte Carlo Simulation - Crashing- Project Budget - Financial Accounting - Schedule and Budget Updates - Quality and Safety

Course Outcome

Upon completion of this course, students should be able to:

- Use the knowledge of various planning techniques to construction projects
- Identify factors influencing duration estimates for project tasks
- Will be able to calculate early and late start/finish times for project tasks
- Will be able to appreciate the impact of scheduling decisions on productivity

Textbooks

1. Chitkara. K.K(1998) “Construction Project Management: Planning Scheduling and Control”, Tata McGraw Hill Publishing Company, New Delhi,
2. Calin M. Popescu, Chotchal Charoenngam (1995), “Project Planning, Scheduling and Control in Construction : An Encyclopedia of terms and Applications”, Wiley, New York,
3. Chris Hendrickson and Tung Au(2000), “Project Management for Construction - Fundamental Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall Pittsburgh

References

1. Moder, J., C. Phillips and E. Davis (1983) “Project Management with CPM, PERT and Precedence Diagramming”, Van Nostrand Reinhold Company, Third Edition, Willis, E. M., Scheduling Construction Projects

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I Basic Concepts In the Development of Construction Plans:-Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities -Estimating Activity Duration. Estimating Resource Requirements for Work Activities -Coding Systems **Nil**	12	**25**
Module II Relevance of Construction Schedules :- The Critical Path Method - Calculations for Critical Path Scheduling -Activity Float and Schedules -Presenting Project Schedules Critical Path Scheduling for Activity-on-Node and with Leads. Lags. and Windows . - Calculations for Scheduling with Leads, Lags and Windows - Resource Oriented Scheduling - Scheduling with Resource Constraints and Preceedences - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Duration -Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Scheduling In Poorly Structured Problems - Improving the Scheduling Process.	14	**25**
Module III The Cost Control Problem :-The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.	10	**25**
Module IV Quality and Safety Concerns in Construction :- Organizing for Quality and Safety - Work and Material Specifications - Work study – factors influencing productivity – tools to assess productivity – productivity improvement techniques -Total Quality Control - Quality Control by Statistical Methods - Statistical Quality Control with Sampling by attributes - Statistical Quality Control with Sampling by Variables - Safety.	10	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6038	PRESTRESSED CONCRETE STRUCTURES**	3-0-0-3	2015
Pre-requisites	Nil		

Course Objectives

To impart to students

- Basic concept of Prestressing, Analysis of prestress and bending stress
- Design of Pretensioned and Post-Tensioned Flexural Members
- Prestressing of statically indeterminate structures
- Composite construction of Prestressed and in situ Concrete

Syllabus

Basic concept of Prestressing,Systems of Prestressing: - Pre tensioning and Post tensioning, Analysis of prestress and bending stress: - Stress concept, Strength concept-Losses of Prestress . Deflection of beams Effect of tendon profile on deflections, Prediction of long term Elastic Design: Shear and Torsional Resistance of PSC members Simplified code procedure for bonded and unbonded symmetrical and unsymmetrical sections.Design of sections for flexure: - Expressions for minimum section modulus, Prestressing force and Eccentricity. Limiting zone for prestressingforce.Design of Pretensioned and Post-Tensioned Flexural Members Prestressing of statically indeterminate structures Concept of Linear transformation, Guyon's theorem, Concordant cable profile.End blocks: - Anchorage zone Stresses Composite construction -Tension membersDesign of Special Structures: Design and analysis of post and pre tensioned PSC slabs

Course Outcome

On completion of the course the students shall attain knowledge on analysis and design of prestressed concrete beams(determinate and indeterminate),post tensioned slabs, tension members etc andComprehend the design of various prestressed concrete members used in practice**.**

Textbooks

1. N. Krishna Raju, "Prestressed concrete", Tata McGraw Hill Publishing Co.Ltd.
2. N. Rajagopal, "Prestressed Concrete", Narosa Publishing House, New Delhi.

References

1. S. Ramamrutham, "Prestressed Concrete", DhanpatRai Publishing Company (P) Ltd., New Delhi.
2. Y. Guyon, "Prestressed Concrete", C. R. Books Ltd., London

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I **Introduction:** Basic concept of Prestressing,Systems of Prestressing: - Pre tensioning and Post tensioning, Thermo elastic and Chemical prestressing. Need of high strength concrete and steel, Advantages of prestressed concrete over reinforced concrete., Analysis of prestress and bending stress: - Stress concept, Strength concept: - Pressure line and internal resisting couple and Load balancing concept for extreme fiber stresses for various tendon profile. **Losses of Prestress:** Losses of Prestress:- Stages of losses,Types of losses in pre-tensioning and post-tensioning due to Elastic shortening, Shrinkage, Creep, Relaxation, Anchorage Slip, Friction and Sudden changes in temperature. **Deflection of beams:** Short term, Load deflection curve, Importance of control of deflections, factors influencing deflections, Pre- cracking and Post- cracking, Effect of tendon profile on deflections, Prediction of long term (Concept only,	10	**25**
Module II **Elastic Design**: Shear and Torsional Resistance of PSC members: - shear and Principal stresses, Ultimate shear resistance of PSC members: - Section cracked and uncracked, Design for shear using IS code. PSC members in torsion:-Pure torsion, Combined bending moment and torsion, Combined bending moment, shear and torsion, modes of failure, Design of reinforcement using IS code provision. Flexuralstrength: - Simplified code procedure for bonded and unbonded symmetrical and unsymmetrical sections. Behavior under flexure: - Codel provision for Limit state design:-Design stress strain curve for concrete. Design of sections for flexure: - Expressions for minimum section modulus, Prestressing force and Eccentricity. Limiting zone for prestressing force. **Design of Pretensioned and Post-Tensioned Flexural Members:** Dimensioning of Flexural members, Estimation of Self Weight of Beams, Design of Pre tensioned and Post tensioned members symmetrical about vertical axis..	12	**25**
Module III **Prestressing of statically indeterminate structures:** Advantages, Effect, Method of achieving continuity, Primary, Secondary and	12	**25**

Resultant moments, Pressure line, Concept of Linear transformation, Guyon's theorem, Concordant cable profile. End blocks: - Anchorage zone Stresses, Stress distribution in end block, Methods of investigation, Anchorage zone reinforcements, Design (IS Code method only)		
Module IV **Composite construction of Prestressed and in situ Concrete:** Types, Analysis of stresses, Differential shrinkage, Flexural strength, Shear strength, Design of composite section. **Tension members:** Load factor, Limit state of cracking, Collapse, Design of sections for axial tension. **Design of Special Structures:** Design and analysis of post and pre tensioned PSC slabs, Pipes, Circular water tanks.(Concepts only)	8	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6148	**BRIDGE ENGINEERING****	**3-0-0-3**	**2015**
Pre-requisites	**Nil**		

Course Objectives

To instruct the students on

- The basic concepts in planning of bridges in terms of geographical location and functionality
- The design of various types of bridges
- The design aspects of bearings ,substructure and foundation
- Construction methods and rehabilitation of bridges

Syllabus

Planning of bridges:– selection of site, design of right, skew and curved slab bridges. Design of girder bridges, balanced cantilever bridges- pre stressed concrete bridges. Design of elastomeric bearings, Substructure design– piers and abutments, Bridge foundations design. Design of composite bridges (steel & concrete).Major construction methods and maintenance and rehabilitation of bridges.

Course Outcome

On completion of the course the students shall attain knowledge on the basic concepts in proportioning and design of various types of bridges, helps to determine the actions to be considered for the design of bridge according to IRC codes, and the design of substructure and foundations for the bridge.

Textbooks

1. Krishna Raju N (1996), “Design of Bridges”, TataMcGrawHill, publishing company, New Delhi.
2. Victor D.J (19991), “Essentials of Bridge Engineering”, Oxford & IBH publishing company, New Delhi.

References

1. Ponnuswami S (1993), “Bridge Engineering”, Tata Mc–GrawHill, publishing company, New Delhi.
2. Raina V.K (1988), “Concrete Bridge Practice– Construction Maintenance &Rehabilitation”, Tata Mc–GrawHill, publishing company, New Delhi

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I **Planning of bridges:** Investigation for bridges– selection of site. Design of RCC bridges– IRC loading– types of bridges– components of bridges– analysis and design of right, skew and curved slab bridge	12	25
Module II **Design of girder bridges:**T-beam bridges– Analysis and design of deck slab, longitudinal girders and cross girders–Pigeaud's method– Courbon's method– Morice and Little method– Hendry–Jaegar method– grillage analogy method- balanced cantilever bridges- prestressed concrete bridges(simply supported case only).	12	25
Module III **Bearings:**importance of bearings– bearings for slab bridges– bearings for girder bridges–Design of elastomeric bearings –Joints –Appurtenances.Substructure- different types- materials for piers and abutments- Forces on piers and abutments- substructure design– piers and abutments and approach structures - Bridge foundations - open, pile, well and caisson.	10	25
Module IV **Design of composite bridges (steel & concrete):**Introduction to analysis and design of long span bridges like suspension and cable stayed bridges. Major construction methods and maintenance and rehabilitation of bridges.	8	25
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6248	**MATRIX METHODS OF STRUCTURAL ANALYSIS**	**3-0-0-3**	**2015**
Pre-requisites	**Nil**		

Course Objectives

To instruct the students on

- The fundamentals of structural analysis and work energy principles
- Concept of matrix analysis of structures
- Advanced methods for the analysis of structures

Syllabus

Stiffness method–coordinate systems–element stiffness matrix. Element approach: Stiffness method – analysis of pin and rigid jointed frames, continuous beams and grids. Direct stiffness approach: analysis of pin jointed frames, continuous beams, Analysis of 2D and 3D truss and frame elements using calculus of variation in finite element method. Flexibility method: analysis of beams & frames (rigid and pin jointed), grids.

Course Outcome

On completion of the course the students shall attain knowledge on the fundamental concepts in the advanced topics in structural analysis. This course is also expected to enable a good understanding of how standard software packages operate.

Textbooks

1. Rajesekharan & Sankarasubramanian,G., “Computational Structural Mechanics”, Prentice Hall of India, 2001.
2. Pandit G.S. and Gupta S.P., “Structural Analysis-A Matrix Approach”, Tata McGraw-Hill PublishingCompany Limited, New Delhi

References

1. Mukhopadhyay M., “Matrix Finite Element Computer and Structural Analysis”, Oxford & IBH, 1984.
2. Reddy C.S., “Basic Structural Analysis”, Tata McGraw Hill Publishing Co.1996.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I **Matrix methods**: Classification of structures–discrete structures–elements–nodes – Generalised Measurements -Degrees of freedom – static& kinematic indeterminacy Constrained Measurements - Behaviour of structures - Principle of superposition- Stiffness method–coordinate systems–element stiffness matrix	10	**25**
Module II **Element approach**: Stiffness method – analysis of pin jointed frames (temperature effect, lack of fit), continuous beams (settlement of supports), rigid jointed frames and grids.	10	**25**
Module III **Direct stiffness approach**: Structure stiffness matrix–assembly–equivalent joint load – incorporation of boundary conditions –solutions–Gauss elimination–matrix inversion– principle of contra-gradience analysis of pin jointed frames, continuous beams. Analysis of framed structure – 2D and 3D truss and frame elements using calculus of variation in finite element method.	12	**25**
Module IV **Flexibility method**: ElementFlexibility matrix–truss element–beam element–force transformation matrix – equilibrium–compatibility–analysis of beams & frames (rigid and pin jointed), grids	10	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6348	ANALYSIS OF PLATES AND SHELLS***	3-0-0-3	2015
Pre-requisites	**Nil**		

Course Objectives

To enable the students to learn

- Classical and modern method of analysis of Love – Kirchhoff theory of thin plates under small deflections.
- Pure bending and symmetrical bending of circular plates.
- Bending of laterally loaded circular plates. Differential Equations.
- Navier and Levy's solutions for simply supported plates.
- Shell theories, shell statics, deformation of shells, Membrane theory of shells,
- Pucher stress function

Syllabus

Pure Bending of Thin Plates, Symmetrical Bending of Circular Plates. Small deflection of laterally loaded plates. Kirchhoff's –Love Theory. Navier and Levy's solutions for rectangular plates. Shells – Geometrical relations. CODAZZI and GAUSS equations. Gauss curvature. Synclastic and anticlastic surfaces. General Shell classification. Shell theories. Love – Kirchhoff theory.Statics of a shell. Basic equation of doubly curved shell. Stress resultants and moment resultants. Membrane theory of doubly curved shell other than shell of revolutions. Pseudo stress resultant . Shell equations of equilibrium. Pucher stress function and applications.

Course Outcome

On successful completion of the course the student will be able to analyse and design plate structures as well as shell structures. A student is expected to acquire skill in the application of Membrane theory to analyse and design shells of different types like hyperbolic paraboloid, elliptic paraboloid and conoids.

Textbooks

1. Theory of Plates and Shells, Stephen P. Timoshenko, S. WoinowskyKrieger , Tata McGraw Hills Ltd Publications 2010.
2. Thin Shell Structures- Classical and Modern Analysis, J.N Bandyopadhyay, Hard cover -2007, New Age International Publications

References

1. Design and Construction of Concrete Shell Roofs , G.S Ramaswamy, CBS Publications

2. Thin Plates and Shells, Theory, Analysis and Applications, Edward Ventsel, TheodorKrauthammer.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I **Plate Theory**: Introduction to Pure Bending of Thin Plates with Small Deflections: Slpoe and curvature of slightly bent plates- Relation between curvature and bending moments in pure bending. Particular cases of pure bending. Symmetrical Bending of Circular Plates:- Differential equation for symmetrical bending of laterally loaded circular plates- Uniformly loaded circular plates- Circular plate with a circular hole at the center- Circular plate concentrically loaded- Circular plate loaded at the center.	10	**25**
Module II **Small Deflections of Laterally Loaded Plates:** The Differential equation of the deflection surface based on Kirchhoff's -Love hypothesis and assumptions. Boundary conditions – Reduction of the problem of bending of a plate to that of deflection of a membrane. **Simply Supported Rectangular Plates Under Sinusoidal Load:**Navier solution for simply supported rectangular plates. Navier solution for a single load uniformly distributed over the area of a small rectangle (Patch Load). Levy's solution for a simply supported and uniformly loaded rectangular plate. Simply supported rectangular plates under hydrostatic pressure.	8	**25**
Module III **Shell Theory:** Introduction to the General Shell Theory: Examples of shell structures in engineering and other fields- Advantages of Shell forms- General definitions and fundamentals. Classifications- Thin shells – Linear shell theories- Love- Kirchhoff hypothesis- First order,second order approximation theories – improved theories- subsequent development of general nonlinear theories and specialized shell theories – shallow shells- Membrane or momentless state of stress. The highest efficiency of a shell as a structural member is associated with its thinness and curvature. **Statics of a shell:**Hookes law for thin shell – Differential element isolated from a shell by means of four sections normal to its middle	9	**25**

surface and tangential to the lines α and α + dα , β and β + dβ. Stress resultants and Couples – Equilibrium of shell element – Six equations of equilibrium (reduced to 5 with 8 unknowns)- Reduced to three equations of equilibrium- Expressions for stress resultants and stress couples in terms of strains and curvatures. **Folded Plates:** Classifications, applications – analysis methods		
Module IV **Deformation of Sells:** Definitions and notations- Stress resultants and moment resultants – Bending strain considering the unit elongation of a thin lamina at a distance from the middle surface – Considering radii of curvature after deformation and stretching of the middle surface – Resultant forces per unit length and moment resultants in terms of the three components of the strains of the middle surface and three quantities representing the changes of curvature and the twist of the middle surface. Discussion on deformation of shells where bending stresses can be neglected and membrane theory can be accepted. Shells in the form of surface of revolution and loaded symmetrically with respect to their axis: Particular cases of shell in the form of surface of revolution – Spherical Dome. Membrane Theory of Cylindrical Shells: Equations of equilibrium and solutions. **Membrane Theory of Shells of Double Curvature other than Shells of Revolution :** Geometrical relations – Radius vector of a point on a surface given in the form z = f(x,y) – Area of element – the first and second quadratic forms- Equations of CODAZZI and GAUSS. Principal curvatures – Gauss curvature. Synclastic , developable or anticlastic surfaces. **Pseudo stress resultant:** Equations of equilibrium – Reduction of three equations of equilibrium to a single differential equation by introducing a stress function as suggested by Pucher . A shell in the form of an Elliptic Paraboloid – A shell in the form of a Hyperbolic Paraboloid.	15	**25**
End Semester Exam		

Course No.	**Course Title**	**L-T-P-Credits**	**Year of Introduction**
06CE6158	**MICROSTRUCTURE AND INNOVATIONS IN STRUCTURAL CONCRETE**	**3-0-0-3**	**2015**

Pre-requisites	**Basic Knowledge of Engineering chemistry and physics**

Course Objectives

To familiarize the students with the concept of the microstructure of concrete, its engineering properties and the recent advancement in concrete making so that they can cope up with the modern developments in construction industry.

Syllabus

Microstructure of cement paste- property relationship in hydrated cement paste- Characteristic and requirement of Self-compacting Concrete- requirement of SCC in fresh state – test methods- temperature effect on concrete – Material properties under temperature – Pozzolanic reaction of different materials – Characterization of concrete using XRD, SEM, and TGA

Course Outcome

The students can apply the knowledge of the various complexities and significances of concrete, the effects of temperature on concrete, characteristics of high performance concrete, self compacting concrete and their engineering properties in an elaborate manner.

Textbooks

1. P. Kumar Mehta and Paulo J. M. Monteiro, “Concrete, Microstructure, Properties and Materials” Indian Concrete Institute, Chennai.
2. J.A. Purkiss, “Fire Safety Engineering” Butterworth-Heinemann.
3. E.G. Butcher and A.C. Parnell, “Designing for Fire Safety” John Wiley and Sons.
4. E.E. Smith and T.Z. Harmathy, “Design Buildings for Fire Safety” ASTM Special Technical Publication 685, A Symposium Sponsored by ASTM Committee EQ5 on Fire Standards.
5. A.M. Neville, “Properties of Concrete” Addison Wesley Longman Limited, England.
6. A.M. Neville and J.J. Brooks, “Concrete Technology” Pearson Education, Asia.
7. P.C. Varghese, “Advanced Reinforced Concrete Design” PHI Learning Private Limited, New Delhi.

References

1. P.J.M. Bartos, M. Sonebi and A.K. Tamimi, “Workability and Rheology of Fresh Concrete: Compendium of Tests” RILEM Publications S.A.R.L,France.
2. V.S. Ramachandran and James J., “Handbook of Analytical Techniques in Concrete Science and Technology, Principles, Techniques and Applications” William Andrew Publishing, U.S.A.

3. George Widmann, “Interpreting TGA Curves” User Com.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I The Structure of Concrete: - Significance and Complexities, Structure of aggregate phase, Structure of hydrated cement paste, Solids in hydrated cement paste, Voids in hydrated cement paste and Water in hydrated cement paste. Structure property relationships in hydrated cement paste:- Strength, Dimensional stability and Durability. Transition zone in concrete: - Significance of transition zone, Structure of transition zone, Strength of transition zone and Influence of transition zone on properties of concrete.	12	**25**
Module II Self-compacting Concrete:- Introduction, Definition and terms like Addition, admixture, Binder, Filling ability, Fines (Powder), Flow ability, Fluidity, Passing ability, Robustness, Segregation resistance, Slump-flow, Thixotrophy, Viscosity modifying admixture, constituent materials, Mix design, Test methods and conformation. Engineering Properties:- Compressive strength, Tensile strength, Modulus of elasticity, Creep, Shrinkage, Coefficient of thermal expansion, Bond to reinforcement, Shear force capacity, Fire resistance and durability. Requirements:- Basic and Additional requirements and Requirements in fresh state, Consistence classification, Slump flow, Viscosity, Passing ability and Segregation resistance.	10	**25**
Module III Effect of Temperature on Concrete:- Stressed, Unstressed and Unstressed residual test methods. Important material properties of concrete under temperature:- Thermal expansion, Thermal conductivity, Thermal capacity and thermal diffusivity, Modulus of elasticity, Poisson’s ratio, Stress-strain relationship and Creep deformation. Strength: - Compressive and Tensile. Influence of aggregate type.	10	**25**

Module IV Supplementary Cementitious Materials:- Different materials- Glass, Saw dust ash, fly ash, Silica fume - Pozzolanic reaction. Characterization of Concrete (Concept Only):- X-Ray Diffraction Analysis (XRD):- Introduction, Basic Principle, Identification of Major Phases Present in Cement/Clinker, Sample Preparation and X-Ray Diffractometry in Concrete, Hydrated Cement Paste, Aggregate Interface. Scanning Electron Microscope (SEM) Analysis: Introduction of Scanning Electron Microscopy, Specimen Preparation, Concrete under the SEM, Mineral Admixtures in Concrete. Thermo Gravimetric Analysis (TGA): - Introduction, Interpreting TGA Curves related to Concrete	14	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6258	REPAIR AND MAINTENANCE OF STRUCTURES	3-0-0-3	2015
Pre-requisites	Nil		

Course Objectives

1. To introduce the concepts of repair, retrofitting, rehabilitation and restoration and to identify the damages occurring during construction.
2. To provide a comprehensive knowledge on the diagnosis, assessment and material applications related to maintenance and rehabilitation of structures.

Syllabus

Damage Causes - Investigation and diagnosis - repair materials –polymer, sprayed concrete- Protective coatings - Underwater repair - Non Destructive Testing

Course Outcome

Students will be able to acquire knowledge about various retrofitting and rehabilitation techniques to be adopted in the field of work.

Textbooks

1. Agarwal P & Shrikahande M -, Earthquake resistant design of structures, Prentice Hall of India Pvt Ltd.
2. R Santhakumar – Concrete technology, Oxford University Press, New Delhi.

References

1. A. R Santhakumar – Concrete technology, Oxford University Press, New Delhi.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I Importance of maintenance - Causes of damage – effects due to climate, temperature, chemicals, and corrosion – design and construction errors - damages occurring during construction: Cracks- surface texture defects- color variation surface blemishes- lack of cover. Concrete floors: causes of defects – floor slabs – screeds- toppings. Investigation and diagnosis – aspects of inspection – assessment procedure for evaluating a damaged structure.	12	25

Module II Concrete repair materials and methods: Portland cement- high alumina cement- aggregate- column or beam jacketing - Polymers for concrete repair: polymer modified cementation systems- resin repair mortars- properties of polymer based repair materials- polymer bonding aids- repair of cracks/ resin injection- external bonding of steel plates – polymer impregnation. Repairs to cracked concrete: purpose- classification- cracks with and without further movement expected- vacuum impregnation. Hand applied repair of spalled concrete: preparation – choice of material – cement based – resin based- curing	14	**25**
Module III Sprayed concrete: Dry and wet process – plants and equipments – properties – specification – requirements- quality control – workman ship – practical aspects. Large volume repairs: preparation – form work – mix design – placing and compacting – grouted aggregate construction – curing. Leak sealing: site investigation- conventional methods – surface seals – liquid flow and pressure consideration – sealing from downstream side – injection techniques – equipments and materials – methods in tunnels or pipelines Protective coatings in concrete repair and maintenance: need – types- surface preparation – methods of paint application – selection of protective coating	10	**25**
Module IV Underwater repair: preparation – patch repair – injection – large scale placement. Repair of structures damaged due to earthquakes – Non Destructive Testing	12	
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6358	QUANTITATIVE TECHNIQUES IN CONSTRUCTION MANAGEMENT#	3-0-0-3	2015
Pre-requisites	Nil		

Course Objectives

To study the various quantitative techniques applied to construction industry.

Syllabus

Linear programming-Graphical and Simplex Methods, Duality and Post- Optimality Analysis-Transportation and Assignment Problems. Inventory control-Quality control - Inventory control-working capital management-Decision Making & Risk Analysis.

Course Outcome

On completion of this course students will be able to solve different problems related to construction projects which involves operation research, production management and financial management.

Textbooks

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.

References

1. Frank Harrison, E., “The Managerial Decision Making Process ",Houghton Mifflin, 1995.
2. RL Varshney and KL Maheshwari , “Managerial economics”, Sultan Chand, 1990.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I Operations Research- Introduction to Operations research-Linear	10	25

programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems.		
Module II Production Management Inventory control: EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM -Simulation Models-Quality Control.	12	**25**
Module III Financial Management: Working Capital Management- Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting	10	**25**
Module IV Decision Making & Risk Analysis - Decision Theory-Decision Rules-Decision making under conditions of certainty, risk and uncertainty-Decision trees-Utility Theory Cost concept -Pricing techniques Game Theory application.	10	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6068	**MINI PROJECT**	**0-0-4-2**	**2015**
Pre-requisites	**STAAD Pro.,SAP 2000,NISA**		

Course Objectives

To give the students an understanding on effective use of a suitable design/analysis software package.

Syllabus

During the course of the second semester each student need to undertake mini project. The student can execute this project by effective use of a suitable design/analysis software package. This may be as far as possible, a software studied as part of the curriculum or any other suitable package. In any case, at the end of the mini project, the student should be well versed with the different aspects of the software. Each student must keep a project notebook, which shall be checked periodically throughout the semester, as part of evaluation. At the end of the training student shall submit a report in the prescribed format to the department.

Assessment process

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the mini project based on the report submitted and the presentation made. Marks will be awarded out of 100 assigned as per the regulations.

Course Outcome

After the successful completion of the mini project, the students should be capable of conducting the analysis and design of structures and be well versed in the software package chosen.

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE6078	**COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN LAB**	**0-0-2-1**	**2015**
Pre-requisites	**Nil**		

Course Objectives

To instruct the students on

- Practical training related to structural engineering.
- Ability to solve stress analysis problems.
- Structural analysis & design software STAAD, ETABS & ANSYS

Syllabus

Structural Analysis & Design using the following software

STAAD

The student has to practice the packages by working out different types of problems.

1. Analysis and design of various structural elements like beams, portal frames etc.

2. Analysis and design of trusses

3. Analysis and design of framed structures

Loading : Dead Load, Live Load, Wind Load (IS: 875 Part 1 / Part 2 / Part 3), Earth Quake

Load (IS: 1893 Part 1) and its Combinations as per codal Provisions

ETABS

Linear Static Analysis of Continuous Beams, Portal Frames, Truss (2D and 3D),

Multistoried Building.

Loading : Dead Load, Live Load, Wind Load (IS: 875 Part 1 / Part 2 / Part 3), Earth Quake

Load (IS: 1893 Part 1) and its Combinations as per codal Provisions

Linear dynamic analysis of Continuous Beams, Portal Frames

ANSYS

Linear Static Analysis of Continuous Beams, Portal Frames, Truss (2D and 3D), Plates

(Plane Stress and Plane Strain)

Linear dynamic analysis of Continuous Beams, Portal Frames

Course Outcome

The student shall be able to analyse and design various structural components for different types of loading.

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7117	ADVANCED DESIGN OF STEEL STRUCTURES	3-0-0-3	2015
Pre-requisites	Basic knowledge of structural analysis Basic knowledge of Steel design		

Course Objectives

- To learn the behaviour and design of steel structures, such as light gauge sections, Crane gantry girders, bridges etc
- To develop the ability to perform analysis and design of steel structures

Syllabus

Plastic Theory- limit state design- Industrial buildings - steel towers - Light gauge sections - Cold form steel – Steel bridges

Course Outcome

The students will acquire knowledge of behaviour and design of steel structures, such as light gauge sections, Crane gantry girders, bridges etc
The student will be able to perform analysis and design of various steel structures

Textbooks

1. Arya, A.S, “Design of Steel Structures”, Newchand & bros, Roorkee, 1982
2. Ram Chandra, “Design of Steel Structures II”, Standard Book House, Delhi.
3. Dayaratnam, “Design of steel structures”.
4. Rajagopalan, “Design of Storage structures”.
5. Baker, “Steel skeleton”.

References

1. S.K.Duggal , “Design of Steel Structures”, McGraw Hill.
2. Lynn S.Beedle, “Plastic Analysis of steel frames”.
3. J. Rhodes and R.M. Lawson "Design of Structures using Cold Formed Steel Sections, SCI Publication 089, The Steel Construction Institute, U.K. 1992.
4. Relevant IS Codes.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I Theory of plastic bending- plastic hinge concept- mechanism method- application of continuous beam- plastic moment distribution Introduction to limit state design, analysis procedure and design philosophy	14	**25**
Module II Design of members subjected to lateral loads and axial loads – Principles of analysis and design of Industrial buildings and bents – Crane gantry girders and crane columns – Bracing of industrial buildings and bents – Earth quake action of industrial building Analysis and design of steel towers, trestles and masts	14	**25**
Module III Design of light gauge sections – Types of cross sections – Local buckling and post buckling – Design of compression and Tension members – Beams – Deflection of beams – Combined stresses and connections. Cold form steel - under compression, under bending – Design of continuous beam and column	12	**25**
Module IV Bridge- classification and type, load and load combination of highway and rail way bridges- Design of typical truss bridge- wind and earthquake effect	14	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7217	STABILITY OF STRUCTURES	3-0-0-3	2015
Pre-requisites	Basic knowledge of Strength of Materials Basic understanding of buckling, crushing and crippling		

Course Objectives

- To impart the need for stability concepts
- To explain buckling
- To demonstrate the critical load computations on different structural members using analytical, approximate and numerical methods

Syllabus

Introduction to stability analysis:–Stable, unstable and neutral equilibrium–Stability Criteria.–Euler's theory–assumptions and limitations - Energy approach and principles-Approximate methods-Rayleigh Ritz–Galerkin's method. General treatment of column:-Stability problem as an Eigen value problem–Short and long columns - Elastic instability of columns Stability of Beam columns:–Beam column equation– Energy method – Solutions for various end conditions–Stability of Frames:-Buckling of frames with and without sway for fixed and hinged end conditions-Energy approach Stability of plates:–Inplane and lateral loads–Introduction to torsional buckling, lateral buckling and inelastic buckling. Finite element application to stability analysis– Finite element stability analysis–Element stiffness matrix –Derivation of element stiffness matrix and geometric stiffness matrix for a beam element.

Course Outcome

On the successful completion of the course students are expected to

- Understand the physical interpretation of buckling
- Compute critical load on columns, beam columns, frames and plates
- Use equilibrium, energy, approximate and numerical methods for the computation of critical loads

Textbooks

1. Ziegler H, "Principles of structural stability", Blarsdell, Wallham, Mass, 1963.
2. Thompson J M, G W Hunt, "General stability of elastic stability", Wiley,New York.
3. Timoshenko, Gere, "Theory of elastic stability", McGraw Hill, New York.

References

1. Don O Brush, B O OAlmorth, Buckling of Bars, plates and shells,
2. Cox H L, The buckling of plates and shells, Macmillam, New York, 1963.

3. O C Zienkiewicz ,.Finite Element Method ,fourth Edition,McGraw Hill.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I **Introduction to stability analysis:**–Stable, unstable and neutral equilibrium–Stability Criteria. Fourth order Elastica – large deflection of bars differential equation for generalized bending problems–Euler's theory–assumptions and limitations -Introduction to methods for the determination of buckling loads on columns – Moment equilibrium method-Fourth order elastica - Energy approach and principles-Approximate methods-Rayleigh Ritz–Galerikin's method.	14	25
Module II **General treatment of column:-** Stability problem as an Eigen value problem–Short and long columnmns - Elastic instability of columns - Various modes of failure for various end conditions–both ends hinged–both ends fixed–one end fixed other end free–one end fixed other end hinged–Energy approach.	14	25
Module III **Stability of Beam columns:**–Beam column equation–Solution of differential equation for various lateral loads–udl and concentrated loads– Energy method – Solutions for various end conditions–bottom fixed– bottom hinged –Horizontal compression members- **Stability of Frames**:-Buckling of frames with and without sway for fixed and hinged end conditions-Energy approach	16	30
Module IV **Stability of plates:–**Inplane and lateral loads– Boundary conditions–Critical buckling pressure–Aspect ratio – Introduction to torsional buckling, lateral buckling and inelastic buckling. **Finite element application to stability analysis**– Finite element stability analysis–Element stiffness matrix –Geometric stiffness matrix–Derivation of element stiffness matrix and geometric stiffness matrix for a beam element.	12	20
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7317	ADVANCED FOUNDATION ENGINEERING	3-0-0-3	2015
Pre-requisites	**Basic knowledge about the soil properties and geomechanics**		

Course Objectives

- To impart knowledge about various soil exploration techniques and testing.
- To enable students to select the best foundation solution for different types of civil engineering problems
- To impart knowledge of design of various foundations such as pile foundation, machine foundation etc. and correct selection of soil parameters for foundation design

Syllabus

Soil Exploration and testing-, Field CBR test-Plate Load Test - Geophysical Methods, Soil report - Bore hole Log - Foundation classification - Settlement of foundations - Classification of pile foundations - Pile load test- Wells and Caissons - Machine foundation - Types of Isolation - Construction aspects of machine foundation

Course Outcome

On completing the course the student should be able to:

- Design and analyse foundation systems using conventional methods
- Design appropriate foundation systems based on ground-investigation data and be able to select correct soil parameters for the designs

Textbooks

1. Bowles JE, Foundation analysis and design, Mc Graw Hill
2. G.A.Leonards - Foundation Engineering-Mc Graw Hill Book Co.
3. Gopal Ranjan &ASR Rao-Basic applied Soil Mechanics, New Age International publishers

References

1. N.P.Kurian, Design of foundation systems-Narosa Publishing House, Madras
2. W.C.Teng. Foundation Design-Prentice Hall of India Pvt. Ltd, New Delhi
3. Tomlinson M.J Pile design and construction practice-Point Publications, London

Course Plan

Contents	Contact	Sem. Exam

	Hours	Marks
Module I Soil Exploration and testing: Methods of exploration-Boring, Sampling of soils, Bore log-Standard penetration Test-Field Vane shear Test-Static Cone Penetration Test-Dynamic Cone penetration tests, Operation of Penetrometer, Field CBR test-Plate Load Test, Geophysical Methods, Soil report, Bore hole Log	12	**25**
Module II Foundation classification: Selection of foundations; Geotechnical design parameters- Bearing capacity – Methods by Terzaghi, Meyerhoff, Hansen and IS Code, Proportioning of Foundations for equal settlement, loads for design, depth of foundation, concepts of net and gross loads. Analysis of shallow foundations in clay and sand - individual and combined footings, and rafts - floating and partially compensated. Settlement of foundations-immediate settlement –consolidation settlement-Total and differential settlement-causes –permissible settlements	14	**25**
Module III Classification of pile foundations – Selection of pile foundations - friction piles, end bearing piles, laterally loaded piles, Load carrying capacity of individual piles – static formula, IS Method, dynamic formula, Pile load test – pull out test, lateral load test, initial load test, routine load test and cyclic load test, negative skin friction, pile spacing and group action, Settlement analysis of individual and group of piles Wells and Caissons- types of well foundations-Depth of wells-bearing capacity-Design and construction of wells and caissons –sinking of wells	12	**25**
Module IV Machine foundation : Introduction, Simple harmonic motion, fundamentals of vibration, Modes of vibration, Free and forced vibration with and without damping, Amplitude excitation, Quadratic excitation, Types of machines and machine foundation, General criteria for design of machine foundation, Vibration Analysis for machine foundation, Elastic half space theory for rigid footings, Foundation for reciprocating machines, Vibration Isolation – Types of Isolation, Method of isolation, Isolating materials.	12	**25**

Construction aspects of machine foundation – concrete, Reinforcement, Expansion joints, connecting elements, spring absorbers		
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7127	QUALITY MANAGEMENT & SAFETY IN CONSTRUCTION ENGINEERING*	3-0-0-3	2015
Pre-requisites	Nil		

Course Objectives

- To understand the elements of quality planning and its implication.
- To create awareness about the advantages of quality assurance and means of quality control.
- To study the quality management system in construction.
- To study and understand the various safety concepts and its requirement in construction projects.

Syllabus

Quality Assurance and Control, Safety aspects in construction industry, Safety in material handling and equipments, Effect of temperature on properties of building materials, Classification of buildings.

Course Outcome

The students will be able to gain knowledge about the importance of quality and safety in construction and will be skilled to manage both at work place.

Textbooks

1. Construction Safety Management – K.N.Vaid
2. Construction Safety Security & Loss Prevention – J.B.Fullman
3. Modern Methods of Material Handling –Linger.L
4. Fire Safety in Building – V.A.K. Jain
5. Occupational Safety Management & Engineering – Willi Hammer
6. James, J.O Brien, “Construction Inspection Handbook - Quality Assurance and Quality Control ", Van Nostrand, New York, 1989. 11

References

2. Juran Frank, J.M. and Gryna, F.M. " Quality planning and Analysis ", Tata McGraw Hill, 1982.
3. Steven McCabe, “Quality Improvement Techniques in Construction ", Addisson Wesley Longman Ltd., England, 1998.

Course Plan		
Contents	**Contact Hours**	**Sem. Exam Marks**
Module I Inspection, Control and enforcement, Quality Management Systems and Method, Responsibilities and authorities in Quality assurance and Quality control-Architects, Engineers, Contractors, and Consultants, Quality circle, Quality Management- Quality policy, Objectives and methods in construction industry -Taguchi's concept of quality Codes and standards-Documents- procedures -Total QA / QC Programme	10	**25**
Module II Quality Assurance and Control -Objectives-Regularity agent-Owner, Design, Contract And Construction Oriented Objectives, Methods -Techniques, Quality control by Statistical methods – Sampling by attributes and variables, Needs Of QA/QC - Different Aspects of Quality-Appraisals, Factors Influencing Construction Quality-Critical, Standardization.	10	**25**
Module III Safety aspects in construction industry – human factors – role of different groups in safety –steps in accident recovery. Safety in various construction operations – Excavation – under-water works– Ladders and Scaffolds – Design of scaffolding - Tunneling – Blasting – Demolition – confined Space – National Building Code Provisions on construction safety, Construction safety manuals. Safety in material handling and equipments –storage and stacking of construction materials. Safety in Vehicles, Cranes, Tower Cranes, Wire Ropes, Pulley blocks, Mixers. Temporary power supply. Theories and principles of accident –frequency – rate – serviceability rate – incident rate – activity rate, first aid	12	**25**
Module IV Effect of temperature on properties of building materials – test of combustibility – test of fire resistance of building elements – fire protection. Classification of buildings based on occupancy and fire resistance as per NBC. Fire Zones - Principles of Fire extinguishment – fire bucket, sand bucket, fire	10	**25**

blanket, fire pails and water barrels, horse reels; Description, working principle, method of operation of different types of portable fire extinguishers – water type, foam type, dry powder type, CO2 type, vaporizing liquid type; Care, inspection, and maintenance of portable extinguishers.		
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7227	CONSTRUCTION CONTRACTS AND LEGAL ASPECTS	3-0-0-3	2015
Pre-requisites	NIL		

Course Objectives

To provide an overview of all laws and legal procedures related to construction projects in various stages of project cycle.

Syllabus

Types of contracts - Contractor's obligation - Contract claims and damages – arbitration – dispute - Financial remedies

Course Outcome

Students will be able to apply these laws and legal procedures to deal with the issues in construction industry. Also they will acquire knowledge on formulating and managing construction contracts.

Textbooks

1. Murdoch J R, Hughes W, Construction contracts: Law and Management, Spon Press Taylor and Francis series.
2. M Krishnan Nair – Law of contracts, Orient Longman
3. Avatar Singh – Law of contracts & Specific Relief, Earsten Book Co.

References

1. John G. Betty., "Engineering Contracts", McGraw Hill,2003
2. Patil, B.S., "Building and Engineering Contracts" Mrs. S.B. Patil, Pune.
3. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India ", M.M.Tripathi Private Ltd., Bombay, 1982.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I Indian Contract act: elements of contracts –types of contracts - use	15	25

– characteristics – risks – design and build contracts – management contracts – construction management contracts. Tendering and contract information: meaning of construction contracts – contracts by agreement – contracts by tender; Liability in contract and tort: Law of Torts-express terms – exception clauses – incorporation by reference – implied terms – liability in tort for negligence.		
Module II Contractor's obligation: standard work – statutory obligations – coordination and management – transfer of materials. Employer's obligation: Implied obligation – responsibility of contract administrator – responsibility of site condition – health and safety. Time: commencement – progress – completion – contractor's obligation after completion – extension of time. Payment: employer's obligation to pay – the contract sum – variation – fluctuations – retention money.	15	**25**
Module III Contractor's claim for loss and expenses: contract claims and damages – ground for contractual claims – claims procedure – qualification of claims. Insurance – bonds – guarantees. Sub-contracting: reasons – legal basis – domestic sub contracts – defaults – right – employer's selection of sub contractors – selection procedure.	12	**25**
Module IV Financial remedies for breach of contract: general damages – liquidated damages – quantum merit claims – Non-adversarial dispute resolution: nature – role of contract administrator – dispute resolution; adversarial dispute resolution: adjudication – arbitration – litigation. Specifications and drawings.	14	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7327	DISASTER MANAGEMENT*	3-0-0-3	2015
Pre-requisites	Nil		

Course Objectives

The intent of the course is to give an insight into the impact of disasters, Disaster Management, Disaster Mitigation and Disaster Planning. It also aims at further development and involvement of different organizations in disaster mitigation process.

Syllabus

Disaster Management Cycles Phase II, Phases III and IV and about the Disaster Community and planning ,Disaster Planning

Course Outcome

To enable the students to plan effectively the disaster management system and will be exposed to the mitigation techniques.

Textbooks

1. Dave, P. K.. Emergency Medical Services and Disaster Management: A Holistic Approach. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2009
2. Narayan, B. ,Disaster Management, New Delhi: A.P.H. Publishing Corporation ,2009
3. Kumar, N.. Disaster Management. New Delhi: Alfa Publications. ,2009
4. Ghosh, G. K., Disaster Management. New Delhi: A.P.H Publishing Corporation. ,2008

References

1. Goel, S. L., Disaster Management. New Delhi: Deep & Deep Publication Pvt. Ltd. ,2008
2. Singh, R. B. ,Disaster Management. New Delhi: Rawat Publications., 2008.

Course Plan

Contents	Contact Hours	Sem. Exam Marks
Module I Disaster Management – Causes And Types Of Disasters- -Principles And Components Of Disaster Management - Management Cycle – Phase I: Mitigation, And Strategies; Hazard Identification And Vulnerability Analysis- Emerging Trends In Disaster Mitigation- Sustainable Development For Disaster Mitigation – Disaster forecasting	10	25

Module II Phases-Disaster Management Cycle – Phase II: Preparedness, Disaster Risk Reduction(DRR), Emergency Operation Plan (EOP), Mainstreaming Child Protection and Gender in Emergency Planning, Assessment, Disaster Management Cycle – Phases III and IV: Response and recovery, Response aims, Response Activities, Modern and traditional responses to disasters, Disaster Recovery, and Plan , Disasters as opportunities for development initiatives	12	**25**
Module III Disaster Community-Community-based Initiatives in Disaster management -Based Approach, categories of involved organizations: Government, Non-government organizations (NGOs), Regional And International Organizations, Panchayaths, Community Workers, National And Local Disaster Managers, Policy Makers, Grass-Roots Workers, Methods Of Dissemination Of Information, Community-Based Action Plan	10	**25**
Module IV Disaster Planning-Disaster Response Personnel and duties, Community Mitigation Goals, PreDisaster Mitigation Plan, Personnel Training, Volunteer Assistance, School-based Programme	10	**25**
End Semester Exam		

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7037	SEMINAR	0-0-2-2	2015
Pre-requisites	Nil		

Course Objectives

To enable the students to

- refer national & international journals
- interpret the data available and present the same in a systematic manner.

Syllabus

Students have to register for the seminar and select a topic in consultation with any faculty member offering courses for the programme. The paper should be a detailed study on a recent advancement/trend in the field of structural engineering or construction management. A detailed write-up on the topic of the seminar is to be prepared in the prescribed format given by the Department. The seminar shall be of 30 minutes duration and a committee with the Head of the department as the chairman and two faculty members from the department as members shall evaluate the seminar based on the coverage of the topic, presentation and ability to answer the questions put forward by the committee.

Course Outcome

The student will be able to present the seminar in a befitting manner and answer to the queries regarding the selected topic.

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7047	RESEARCH PROJECT (PHASE 1)	0-0-8-6	2015
Pre-requisites	Nil		

Course Objectives

Syllabus

The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Project work is to be evaluated both in the third and the fourth semesters. Based on these evaluations the grade is finalised in the fourth semester. Each student is expected to do an individual project.

Normally, students are expected to do the project within the college. However, they are permitted to do the project in an industry or in a government research institute under a qualified supervisor from that organization. Progress of the project work is to be evaluated at the end of the third semester. For this, a committee headed by the head of the department with two other faculty members in the area of the project, of which one shall be the project supervisor. If the project is done outside the college , (provision is available for them only in the fourth semester), the external supervisor associated with the student will also be a member of the committee. Final evaluation of the project will be taken up only on completion of the project in the fourth semester. This shall be done by a committee constituted for the purpose by the principal of the college. The concerned head of the department shall be the chairman of this committee. It shall have two senior faculty members from the same department, project supervisor and the external supervisor, if any, of the student and an external expert either from an academic/R&D organization or from Industry as members. Final project grading shall take into account the progress evaluation done in the third semester and the project evaluation in the fourth semester. If the quantum of work done by the candidate is found to be unsatisfactory, the committee may extend the duration of the project up to one more semester, giving reasons for this in writing to the student. Normally further extension will not be granted and there shall be no provision to register again for the project. M.Tech projects should be socially relevant and research oriented ones.

Project evaluation weights shall be as follows:-

Marks in III Semester: 50

Progress evaluation by the Project Supervisor : 20 Marks

Presentation and evaluation by the committee : 30 Marks

Course Outcome

On completion of the project (Phase 1) the student is expected to conduct preliminary work and review previous literatures on a relevant and research oriented topic to be continued in the following semester.

Course No.	Course Title	L-T-P-Credits	Year of Introduction
06CE7018	RESEARCH PROJECT (PHASE 2)	0-0-21-12	2015
Pre-requisites			

Course Objectives

Syllabus

Phase II of the project work shall be in continuation of Phase I ONLY. At the completion of a project, the student shall submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. The method of assessment for Phase II is as given:

Marks in IV semester : 100

Project evaluation by the supervisor/s : 30 Marks

Presentation & evaluation by the Committee : 30 Marks

Evaluation by the External expert : 40 Marks

Course Outcome

At the successful completion of a project, the student will be well versed in the work and should submit a report of the work done.