KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL
DEPARTMENT OF CIVIL ENGINEERING
Scheme of Instruction and Evaluation for Two-Year Postgraduate Programme
M.TECH (STRUCTURAL & CONSTRUCTION ENGINEERING)

SEMESTER – I

Course Code	Course Name	Periods/Week		Credits	Scheme of Evaluation				
					CIE			ESE	Total Marks
		L	P		TA	MSE	Total		
P14SC101	Numerical and Statistical Methods	3	1	4	15	25	40	60	100
P14SC102	Limit Analysis of Reinforced Concrete Structures	3	1	4	15	25	40	60	100
P14SC103	Construction Planning and Management	3	1	4	15	25	40	60	100
P14SC104	Structural Dynamics	3	1	4	15	25	40	60	100
P14SC105	Elective – I	3	1	4	15	25	40	60	100
P14SC106	Elective – II	3	1	4	15	25	40	60	100
P14SC107	Advanced Concrete Technology Lab	-	3	2	40	-	40	60	100
P14SC108	Computer Aided Design Laboratory	-	3	2	40	-	40	60	100
P14SC109	Seminar	-	3	2	100	-	100	-	100
Total		**18**	**15**	**30**	**270**	**150**	**420**	**480**	**900**

Elective – I
P14SC105A. Advanced Analysis of Structures
P14SC105B. Repair and Rehabilitation of Structures
P14SC105C. Composite Construction Materials
P14SC105D. Pavement Analysis and Design

Elective - II
P14SC106A. Advanced Concrete Technology
P14SC106B. Structural Health Monitoring
P14SC106C. Building services and maintenance Management
P14SC106D. Machine Foundation

P14SC101 NUMERICAL & STATISTICAL METHODS

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *To introduce advanced methods of solving a linear system of equations*
- *To introduce the methods of solving an ordinary/ partial differential equation numerically.*
- *To introduce the statistical methods to apply to Engineering problems.*
- *To introduce various probability distributions needed for a civil engineering*

UNIT-I (9+3)

Linear System of Equations

Solution of Linear Systems – Direct Methods: Gauss-Jordon Elimination Method - Triangularization Method - Cholesky method - Partition Method, Iteration Methods: Jacobi iteration method - Gauss – Siedel Iteration Method - Relaxation Method

Eigen values of Matrices:

The eigen value problem**;** To determine largest eigen value by Power method

UNIT-II (9+3)

Classification and Presentation of Data

Analysis and Treatment of Data, Measures of Central Tendency, Measures of Disperson, Measures of Symmetry, Measures of Peakedness.

Regression Analysis

Correlation. Simple Linear Regression, Evaluation of Regression, Multiple Linear Regression

UNIT-III (9+3)

Discrete Probability Distribution Functions:

Probability function, Mean and variance of a discrete probability distribution. Binomial, and Poisson distributions

Continuous Probability Distribution Functions:

Probability density function, Normal, Lognormal, Exponential, Gamma Distributions, Simple treatment of Joint Probability distributions.

UNIT-IV (9+3)

Numerical Solution of Ordinary Differential Equations:

Introduction – Concept of a numerical solution of a differential equation- Initial value problems, Picards method, successive approximations, Euler Method, Runge-Kutta Methods. Predicator – corrector Methods; Adams – Moulton Method. Milne's method, Cubic spline method.

Numerical Solution of Partial Differential Equations:
Second-order linear partial differential equations: Finite – difference approximations to Derivatives. Numerical solution of Laplace equation, Parabolic equation and Hyperbolic equation.

Text Books:

1. S.S. Sastry - *Introduction Methods of Numerical Analysis* – Prentice Hall of India (1998).
2. M.K.Jain, S.R.K. Iyengar and R.K. Jain., - *Numerical Methods for Scientific and Engineering Computations* –Wiley Eastern Limited (2001).
3. Hann C.T. – *Statistical Methods in Hydrology* – East West Press, New Delhi.

Reference Books:

1. M.K. Jain, "*Numerical Analysis for Scientists and Engineers*" SBW Publishers (1971).
2. Akai T.J. "*Applied Numerical Methods for Engineers,* John Wiley Inc., New York.
3. Charpa S.C and Canale R.P., "*Numerical Methods for Engineers with Personal Computer Applications*" Mc.Graw Hill Publishing Co.,
4. Alfredo H.S., Wilson H.Tang, "*Probability Concepts in Engineering, Planning and Design, Vol. I & II*", Wiley International

***Course Learning Outcome*:**
After completion of the course, the student will be able to

- *Solve the system of linear equations by direct methods/ iterative methods.*
- *Find numerical solution of a given ordinary differential equation by single step/ multi step numerical methods.*
- *Solve a given a partial differential equation numerically using finite deference schemes.*
- *Analyze data using statistical methods and probability distributions*

P14SC102 LIMIT ANALAYSIS OF REINFORCED CONCRETE STRUCTURES

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *Review of design philosophies in RCC and design of reinforced concrete beams*
- *Give the concepts of moments in ductile members and design of columns*
- *Behaviors of reinforced concrete structures in shear and tension*
- *Design of reinforced concrete for the serviceability using limit state deign*

UNIT –I (9+3)

Design philosophies.
Design philosophies of reinforced concrete structures, Review of working stress method, ultimate load method

Limit state design.
Review of limit state design, application of Limit state collapse in flexure, application to reinforced concrete beams.

UNIT –II (9+3)

Moment-Curvature.
Deformation and ductility of members in flexure, Moment-Curvature relationships, Curvature of a member, theoretical Moment-Curvature determination.

Columns.
Behaviour of columns**,** Rectangular and circular columns – Interaction diagrams – uniaxialbending – design for Bi-axial bending, Design of slender columns.

UNIT –III (9+3)

Shear
Behaviour of RC structure in shear, Principle mechanism of shear Resistance, Beam and Arch action, Mode of Shear failure, Shear failure mechanisms, shear strength of beam with and without shear reinforcement.

Torsion.
Behaviour of RC structure in torsion**,** Types of torsion, behaviour plain concrete beams under torsion, Skew bending and space truss analogy for RC members, combined bending and torsion, combined shear and torsion, design of beams in combined shear, bending and torsion as per IS code.

UNIT –IV (9+3)

Serviceability.
Limit state of serviceability**,** Short term deflections, long term deflections, total deflections, – cracks in RC members, calculation of crack width.

Yield line theory.
Yield line theory of slabs, Behaviour of slabs up to failure, yield criteria, methods of analysis using virtual and equilibrium method, design of slabs.

Text Books:

1. Park and Paulay,.*"Reinforced Concrete Structures". John WQilley& Sons*
2. Unnikrishnapillai&Devadas Menon., *"Reinforced Concrete Design",* Tata McGraw-Hill Education
3. Jain A. K., "*Reinforced Concrete Design",*Nem Chand Bros. Roorkee.
4. Shah H. J., "*Reinforced Concrete Design".,*Charotar Publications, Anand.
5. Vargeese P.C. "*Limit State Design of Reinforced Concrete*", PHI, Limited.

Course Learning Outcomes:

After completion of the course, the student will be able to

- *understand the various philosophies of reinforced concrete design.*
- *To design the beams and columns.*
- *To analyse the design of reinforced flexural members and serviceability*
- *understand the background of structural concrete codal concepts and their design*

P14SC103 CONSTRUCTION PLANNING AND MANAGEMENT

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *To make them understand the concepts of construction planning in project management.*
- *To develop ability to form a network diagram and analyze the cost for scheduling the project*
- *To understand the professional ethics, rules and responsibilities of a construction manager.*
- *To analyze the concept of management information system in construction industry.*

UNIT –I (9+3)

Introduction

Project management and its importance, Structure of project, Management levels.

Construction Planning

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

UNIT –II (9+3)

Scheduling and Networking

Scheduling calculations, Techniques – Critical Path Method & PERT- Line of balance, Usage of applications for Scheduling

Cost analysis and control.

Direct cost, Indirect cost, Optimization of cost, forecasting budget, Resource allocation and leveling for limited and unlimited resources, Multi Resource allocation.

UNIT –III (9+3)

Construction Management

Importance of construction management, objectives and functions of construction management, Functions and Responsibilities of Construction Manager, Construction material management, Human factors in construction management.

Decision Making Process.

Introduction to decision making process in construction industry, Benefit/cost analysis, Replacement analysis, Break even analysis.

UNIT –IV (9+3)

Management Information systems.

Introduction to management information systems, Need for management information

Computer applications in Management.

Need for computer applications in construction industry and computer processing of information.

Text Books:

1. Chitkara, K.K. "*Construction Project Management Planning*", Scheduling and Control, Tata McGrawHill Publishing Co., New Delhi, 1998.
2. Moder, J.J., Phillips, C.R., and Davis, E.W., "*Project Management with CPM and PERT and precedence diagramming*", C.B.S. Publishers & Distributors, New Delhi, 1986.
3. Pilcher, R., "*Project Cost Control in Construction*", Collins, London, 1992.
4. Brien. J.J., "*CPM in Construction Management*", McGraw Hill Book Co. Inc., NY, 1971.
5. S.Seetharaman, "*Construction Engineering and Management*", Umesh Publications, New Delhi, 1997.

Reference

1. CallahanM.T., Quackenbush D.G. & Rowings J.E., "*Construction project scheduling*", McGraw-Hill,New York
2. Cleland.D.I& , Ireland L.R., "*Project management and strategic design and Implementation*" 4th Edn., Mc-Graw-Hill, New York

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Identify desirable characteristics of effective project manager.*
- *Develop and schedule the project on/before stipulated time.*
- *Have greater insight into decision-making processes.*
- *Know the modern computer applications in project management.*

P14SC104 STRUCTURAL DYNAMICS

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives

- *The course is aimed at making students understand the working principles of dynamic loads and dynamic response of functions.*
- *Giving students the concepts of single degree and multi degree freedom Vibration systems with and without damping and the solutions to the multi degree freedom Systems using different iteration methods.*
- *The students will also be exposed to continuous systems and numerical evaluation of dynamic response.*
- *The students will be able to analyze various degree of freedom systems.*

UNIT – I (9+3)

Introduction:
Types of dynamic loads, Basic background of methods available and motivation for structural dynamics.

Dynamics of Single Degree-of-Freedom Structures:
Dynamic equation of equilibrium, free vibration of single degree of freedom systems, Forced vibration: harmonic and periodic loadings, Dynamic response functions, force transmission and vibration isolation, SDOF response to arbitrary functions.

UNIT –II (9+3)

Numerical Evaluation of Dynamic Response of SDOF Systems:
Time domain analysis: finite difference methods, Frequency domain analysis: basic methodology.

Earthquake Response of SDOF Systems:
Earthquake excitation, response history and construction of response spectra, Response spectrum characteristics, tripartite plot, and design spectrum.

UNIT– III (9+3)

Multi Degree of Freedom Systems - Basics:
Dynamic equations of equilibrium, static condensation, Symmetric plan and plan-asymmetric systems.

Free Vibration Response of MDOF Systems:
Undamped systems: natural modes and their properties, Numerical solution for the eigenvalue problem, Solution of free vibration response for undamped systems, Free vibration analysis of systems with damping.

UNIT - IV (9+3)

Dynamic Analysis of Linear MDOF Systems:
Introduction, modal analysis, Response-history for earthquake excitations using modal analysis, Response spectrum analysis for peak responses, Concept of Caughey damping as a general type of proportional damping.

Generalized Single Degree of Freedom Systems:
Basic concepts, mass-spring system, lumped mass systems, Systems with distributed mass and elasticity, Rayleigh's method, shape function selection.

Text Books:

1. "*Structural Dynamics - Theory & Computations*"- Mario Paz, Van Nostrand Co., Inc., 1980.
2. "*Vibration problems in Engineering*" Timoshenko Van Nostrand Co., Inc.,1955.
3. "*Introduction to Structural Dynamics*" Biggs McGraw Hill Book Co. 1975
4. "*Dynamics of Structures*" Clough &Penzien McGraw Hill Book Col, 1975
5. "*Dynamics of structures*" Hurty and Rubinsteian
6. "*Dynamics of structures*" A.K. Chopra – Prentice Hall – 1996
7. I.S: 1893 - 2002, *Code of practice for Earthquake resistant design of structures.*

***Course Learning Outcome*:**

- *At the end of the course the students will be able to analyze structures for dynamic action.*
- *Memorize various concepts of single degree of freedom and multi degree of freedom systems with and without damping.*
- *Memorize continuous systems and analyze numerical evaluation of dynamic response.*
- *Analyze various degree of freedom systems.*

P14SC105A ADVANCED ANALYSIS OF STRUCTURES

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives: The objectives of the course is to

- *Give review of flexibility matrix method and its application to continuous beam.*
- *Analyze the rigid and pin jointed frames using flexibility method.*
- *Give review of stiffness matrix method and its application to continuous beam.*
- *Analyze the rigid and pin jointed frames using stiffness method.*

Unit-I (9+3)

Flexibility matrix method

Basics, Introduction, Review of matrix algebra, Force method, Basic concepts, Internal forces, external loads and redundant, Relation between internal forces and deformation, Determination of static indeterminacy for different types of structures.

Continuous Beams

Determination of redundant forces, various load conditions for continuous beams with and without settlement of supports.

UNIT II (9+3)

Rigid jointed frames

Application of Flexibility method rigid jointed plane frames.

Pin Jointed structures

Application of Flexibility method to pin jointed andstresses due to lack of fit.

UNIT III (9+3)

Stiffness matrix method

Basics, Introduction stiffness matrix method, kinematic indeterminacy, Determination kinematic indeterminacy for different types of structures.

Analysis of Continuous Beams – Stiffness Method

Determination of unknown displacements, various load conditions for continuous beams with and without settlement of supports.

UNIT IV (9+3)

Analysis OF frames – Stiffness method

Application of Stiffness method rigid jointed plane frames.

Analysis OF Trusses – Stiffness method

Application of Stiffness method to pin jointed trusses.

Text Books:

1. Weaver & Gere, "*Matrix Analysis of Framed Structures*", CBS Publishers & Distributors, Delhi.
2. Pandit & Gupta, "*Matrix Analysis of Structures*", Tata McGraw-Hill, New Delhi.
3. Bhavikatti S.S., "*Structural Analysis Vol. II*", Vikas Publishing Company Limited, New Delhi.
4. Zeinkiwiez, O.C., "*Finite Element Method*", Mc Graw Hill Co. Ltd. New York.

***Course Learning Outcome*:**

- *Able to analyze the continuous beam using flexibility method.*
- *Can analyze the rigid and pin jointed frames flexibility method.*
- *Able to analyze the continuous beam using stiffness method.*
- *Can analyze the rigid and pin jointed frames stiffness method.*

P14SC105B REPAIRS AND REHABILITATION OF STRTUCTURES

Class: M.Tech. I Semester **Branch: Structural & Construction Engg.**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

Nondestructive tests on concrete
Students to investigate the cause of deterioration of concrete structures.

- *To strategize different repair and rehabilitation of structures.*
- *To evaluate the performance of the materials for repair.*

UNIT-I (9+3)

Introduction

Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations.

Quality assurance

Using NDT, load testing, corrosion mapping, core drilling and other instrumental methods Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.

UNIT-II (9+3)

Influence on Serviceability and Durability

Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion resistant steels, coatings, cathodic protection.

Retrofitting

Introduction & Principles, Retrofitting Procedure for building Structures, Retrofitting of RC Beams and Slabs, Concrete Column Retrofitting

UNIT-III (9+3)

Maintenance and Repair Strategies

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects.

Inspection and Assessment

Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT-IV (9+3)

Materials for Repair

Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Examples of Repair to Structures

Repairs to overcome low member strength, Deflection, Cracking, weathering wear, fire, marine exposure, engineered demolition techniques for dilapidated structures - case studies

Text Books:

1. Sidney, M. Johnson *"Deterioration, Maintenance and Repair of Structures".*
2. Denison Campbell, Allen & Harold Roper, *"Concrete Structures – Materials*, *Maintenance and Repair"*- Longman Scientific and Technical
3. R.T.Allen and S.C. Edwards, *"Repair of Concrete Structures"* Blakie and Sons
4. Raiker R.N., *"Learning for failure from Deficiencies in Design, Construction and Service"*, R&D Center (SDCPL)
5. Xilin LU *"Retrofitting Design of Building Structures"* CRC Press Taylor & Francis Group

Course Learning Outcomes:

On completion of this course, students are able to

Understand the cause of deterioration of concrete structures.
Design and develop analytical skills.
Summarize the principles of repair and rehabilitation of structures
Understands the concept of Serviceability and Durability.

P14SC105C COMPOSITE CONSTRUCTION MATERIALS

Class: M.Tech. I Semester **Branch: Structural & Construction Engg.**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *To provide thorough understanding on cement and cement-composite materials.*
- *Understand the Stress –Strain and mechanical behavior of composite materials.*
- *Understand various cement composites and their construction techniques*
- *Understand the behavior of FRC and ferrocement.*

UNIT-I (9+3)

Introduction

Classification and characteristics of composite materials – basic terminology – advantages.

Classification of Composites

Various types of composites, Classification based on Matrix Material: Organic Matrix Composites (Polymer matrix composites (PMC)/Carbon MatrixComposites or Carbon-Carbon Composites, Metal Matrix composites (MMC), CeramicMatrices composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites/Fiber Reinforced Polymer (FR P) Composites, Laminar Composites, Particulate Composites

UNIT-II (9+3)

Stress-Strain Relations

Orthotropic and anisotropic materials – engineering constants for orthotropic materials – restrictions on elastic constants plane stress problem biaxial strength theories for an orthotropic lamina.

Mechanical Behavior

Mechanics of materials approach to stiffness – determination of relations between elastic constants. Elasticity approach to stiffness – bounding techniques of elasticity – exact solutions

UNIT-III (9+3)

Cement Composites

Types of cement composites – terminology – constituent materials and their properties.

Construction Techniques for Composites

Construction techniques for fibre reinforced concrete, Ferrocement, SIFCON, Polymer concretes – preparation of reinforcement – casting and curing.

UNIT-IV (9+3)

Mechanical Properties of Cement Composites

Behavior of ferrocement, fiber reinforced concrete in tension, compression, flexure, shear, fatigue and impact, durability and corrosion.

Application of Cement Composites

FRC and Ferrocement – housing – Water storage – Boats and miscellaneous structures.

Text Books:

1. Robert Jones, *Mechanics of composite,*
2. R.P., Pama, Ferrocement – *Theory and Applications, International Ferrocement Information Centre, Bangkok.*
3. Balaguruswamy, *Fibre Reinforced Concrete*
4. R.N. Swamy, *New Engineering Materials*

Course Learning Outcomes:

- *Able to explain various cement and cement-composite materials.*
- *Able to analyze the Stress –Strain and mechanical behavior of composite materials.*
- *Able to identify types of cement composites and their construction techniques*
- *Able to analyze the behavior of FRC and ferrocement.*

P14SC105D PAVEMENT ANALYSIS AND DESIGN

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam	60 marks

Course Learning Objectives:

- *To Understand various aspects of pavement analysis*
- *Provides the knowledge about the design of both pavements as per IRC, AASHO.*
- *Understanding the underlying principles relevant to construction of pavements.*
- *Understand the significance of maintenance of pavements.*

UNIT –I (9+3)

Introduction

Types of pavement-factors affecting design of pavement-wheel loads-ESWL concept-tyre pressure- contact pressure- material characteristics.

Stress analysis in pavements

Stresses in flexible pavements- Boussinesq two-layer system- Burmister theory for pavement design. Stresses in rigid pavement Stresses due to friction - stresses due to loads.

UNIT –II (9+3)

Flexible Pavement Design

CBR Method- IRC Method- AASHO Method.

Rigid Pavement Design

IRC method of design-Types of joints- Use of Tie bars and Dowell bars.

UNIT –III (9+3)

Pavement mix design

Requirements of mix design- Marshall method of Bituminous mix design.

Machinery for Construction of Bituminous Roads:

Bitumen boiler- sprayer, pressure distributer, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MORTH specifications.

UNIT –IV (9+3)

Construction of other types of pavements:

Reinforced cement concrete pavements- prestressed concrete pavements- roller compacted concrete pavements and fibre reinforced concrete pavements.

Highway maintenance

Need for highway maintenance- pavement failures both flexible and rigid -types and causes-pavement evaluation-Benkleman Beam method-strengthening of existing pavements-overlays

Text Books:

1. Khanna and Justo, "*Highway Engineering*", Nem Chand and Bros., Roorkee.
2. Yoder and widzorac, "*Principles of Pavement design*" John willey & sons.
3. Peurifoy, R.L., andClifford,JS "*Construction Planning Equipment and Method*" McGraw HillBook Co. Inc.
4. MoRTH '*Specificationsfor Roads and Bridges Works*' Indian Roads Congress
6. "*Bituminousmaterials in Road Construction*", HMSO Publication
7. IRC-37, IRC-58

Course Learning Outcomes :

After completion of the course, the student will be able to

Understand various methods of design for both flexible and rigid pavements.

Know the evaluation of pavement strength.

Recognize the various types of pavement distress and suggest remedial measures.

Understand various techniques for the maintenance of pavements.

P14SC106A ADVANCED CONCRETE TECHNOLOGY

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *The basic principle of mix-designing of various types of concretes*
- *Provides a detailed overview of various materials used in concrete.*
- *Behavior of various materials in concrete.*
- *Durability concepts of concrete.*

UNIT – I (9+3)

High Performance and High Strength Concrete:
Properties of aggregates in high performance concrete, aspects of high performance concrete in the fresh state and of hardened, durability of HPC, The future of HPC

Durability:
Causes of inadequate durability, Diffusion, Absorption, Water permeability - Air and vapour Permeability, Carbonation, Acid and sulphate attack, Effloresence, Disruption by alkali silica reaction-preventive measures Abrasion, erosion, cavitation and types of cracking.

UNIT– II (9+3)

Ferrocement:
Ferrocement Technology, Application, Constituents of ferrocement, Construction Process, preparation of ferrocement, ferocememt repair and methodology.

Fibre Reinforced concrete:
Need for the Fibre Reinforced Concrete (FRC)- Mechanism of FRC. Types of fibres, Behaviour of FRC in tension, compression, flexure, shear, Fatigue, impact and torsion. Durability - corrosion.

UNIT– III (9+3)

Sustainable Concrete:
Concrete with different cementitious materials - Flyash concrete, GGBS concrete and Silica flume.Strength development-Hydration –Durability of above concrete.

Special Concrete:
Light weight concrete, Strength of Light Weight Aggregate- Aspects – Durability, Thermal Properties. Cellular concrete and No fines concrete

UNIT– IV (9+3)

Self Compacting Concrete:

Introduction, History of SCC, Development of SCC, Characteristics and behavior of SCC, Tests on SCC as per EFNARC specifications and Application of SCC.

Self Curing Concrete:

Introduction, Need and Development of Self curing concrete, Characteristics, behavior and application of Self curing concrete, Tests on self Curing Concrete

Text Books:

1. Neville A.M., "*Properties of Concrete*", 4thEdn., English Language Book Society /Longman Pub., 2010.
2. Dr. B.N. Divakar., "*Ferrocement Technology*"
3. StanelyAbercromhie., *Ferrocement*
4. Mehta P.K. and Paulo J.M.M. "*Concrete – Micro Structure - properties and Material*".

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Understand principle of mix-designing of various types of concretes.*
- *Understand different materials used in concrete.*
- *Understand behavior of various materials in concrete.*
- *Understand durability concepts of concrete.*

P14SC106B STRUCTURAL HEALTH MONITORING

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *NDT assessment, static field testing and loading methods.*
- *Dynamic field testing methods.*
- *Hardware Components required for data acquisition system.*
- *Various techniques of structural health monitoring.*

UNIT – I (9+3)

Introduction

Definition of SHM, Motivation for structural health monitoring, Assessment by NDT equipments.

Static testing:

Static field testing- types of static tests- loading methods, Behavioral / Diagnostic tests - Proof tests, Static response measurement – strain gauges, LVDTs, dial gauges- case study

UNIT– II (9+3)

Dynamic Field Testing

Types of dynamic tests, Stress history data, and Dynamic load allowance tests, ambient vibration tests.

Methods of testing

Forced Vibration Method, Dynamic response methods, Impact hammer testing, Shaker testing, Periodic and continuous monitoring.

UNIT - III (9+3)

Data acquisition

Static data acquisition systems, Dynamic data acquisition systems.

Components:

Components of Data acquisition system, Hardware for Remote data acquisition systems.

UNIT - IV (9+3)

Remote structural health monitoring:

Remote Structural Health Monitoring - Importance and Advantages – Methodology.

Technique's of health monitoring:

RF/PSTN/GSM/Satellite Communications, Networking of sensor, Data compression technique, Case Studies.

Text Books:

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, "*Structural Health Monitoring*", John Wiley and Sons, 2006.
2. Douglas E Adams, "*Health Monitoring of Structural Materials and Components-Methods with Applications*", John Wiley and Sons, 2007.
3. J.P. Ou, H.Li and Z.D. Duan, "*Structural Health Monitoring and Intelligent Infrastructure Vol-1*", Taylor and Francis Group, London, U.K, 2006.

Course Learning Outcomes:

After completion of the course, the student will be able to

- *NDT, static field testing methods.*
- *Dynamic field testing methods.*
- *Components of data acquisition system.*
- *Techniques of structural health monitoring.*

P14SC106C BUILDING SERVICES & MAINTAINANCE MANAGEMENT

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 Marks
End Semester Exam:	60 Marks

Course Learning Objectives:

- *Identify various building services and their functional requirements*
- *Understand various fire fighting systems, building transport systems and their planning*
- Understand and plan various plumbing and water supply system.
- Understand miscellaneous services like air conditioning, telecom, LAN and their maintenance.

UNIT –I (9+3)

Introduction and Importance

Importance of building services, type of services required to keep facility usable,

Planning of services

Organization structures of services management. Role and administrative functions of supervisors, functional planning in building.

UNIT –II (9+3)

Fire Fighting

Basic requirement of the works for fighting system, various components of the fire fighting system. Maintenance required of the system, fire fighting in high-rise buildings, commercial/industrial complexes. Public buildings, checklist for fire safety

Lifts/Elevators, Escalators

Legal formalities for elevators, various types of lifts, working mechanisms of lift and escalators. Indian standard codes for planning & installations of elevator, inspection & maintenance of lifts

UNIT –III (9+3)

Plumbing Services

Basics of Plumbing systems. Requirement of Plumbing works, Agency, Activity flow chart for plumbing work. Quality, checking of materials

Water Supply System

Water supply and distribution system is high-rise building & other complexes, pumps and pumping mechanisms. Operation & maintenance of fittings & fixtures of water supply & sanitary. Do's & Don'ts for water pipe networks

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UNIT –IV (9+3)

Building Services and Maintenance

Telecommunication network, computer network LAN, Electrical network & appliances. Basics of single phase & three phase electrification, precautions and safety measures during electrification. Indian standard codes for electrical appliances & wiring operations &

maintenance of network & appliances. Landscaping & Horticulture. Building maintenance management, applications of computer in service management**.**

Air-Conditioning and Heating:
Flowcharts of air conditioning & heating. Centralised systems, monitoring and working of the equipments, Checklist of inspection, Performance testing.

Text Books:

1. IVOR H. Seeley, "*Building Technology*", Mac Millian.
2. Chudley, "*Building Finishes, fittings and domestic service*", Longman Scientific and Technical book"
3. "*Hand book for Building Engineers in Metric systems*", NBC, New Delhi, 1968
4. Fred Hall,"*Building Services & Equipment*",Longman Scientific and Technical.
5. Lee Smith, Harry Slecter,"*Plumbing Technology, Design and installation*", Delmar Publisher INC.
6. Fred Hall, "*Plumbing Cold water supplies, Drainage and Sanitation*" Longman Scientific & Technical.
7. Roger Greeno, "*Building Services, Technology and Design*" Longman.

Course Learning Outcomes:
After completion of the course, the student will be able to
- *Describe various building services and their functional requirements*
- *Explain various fire fighting systems, building transport systems and their planning*
- *Plan various plumbing and water supply system.*
- *Identify and maintenance of miscellaneous building services like air conditioning, telecom, LAN.*

P14SC106D MACHINE FOUDATIONS

Class: M.Tech. Semester: I **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *To analyze the dynamic behavior of foundations.*
- *To Select foundation for dynamic loading*
- *Design foundation for reciprocating machines*
- *Design foundation for rotary & impact machines*

UNIT –I (9+3)

General Principles of Machine Foundation

Introduction, Types of Machines and Foundations, General requirements, Permissible Amplitude.

Machine Foundation Design

Allowable soil pressure, Permissible stress of concrete and steel, Permissible stresses of Timber.

UNIT –II (9+3)

Foundations of Reciprocating Machines

Modes of vibration of a rigid foundation block, methods of analysis, linear elastic weightless spring methods, elastic half space method, and effect of footing shape on vibratory response.

Design of Foundations of Reciprocating Machines

Dynamic response of embedded bock foundations, soil mass participating in vibrations, design procedure for a block foundation.

UNIT –III (9+3)

Foundations of Impact Machines:

Introduction, Dynamic analysis; single degree freedom system, Multi degree freedom system.

Design procedures for foundations of Impact Machines

Determination of initial velocity of hammer, stress in the pad, stresses in the soil, design procedure for a hammer foundation.

UNIT –IV (9+3)

Foundations of Rotary Machines

Introduction, special considerations, design criteria, loads on a turbo generator foundation, methods of analysis and design, resonance method, amplitude method, combined method, three dimensional analysis.

Vibration isolation and screening:
Introduction, force isolation, motion isolation, screening of vibrations by use of open trenches, passive screening by use of pile barriers, problems.

Text Books:

1. Srinivasulu, P. And Vaidyanathan, C. V., "*Handbook of Machine Foundations*" Tata McGraw Hill, New Delhi, 2001
2. Prakash Shamsher and Puri Vijay K, "*Foundations for Machines, Analysis and Design*" John Wiley and Sons, USA, 1988.

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Understand the dynamic behavior of foundations.*
- *Select foundation for dynamic loading*
- *Design machine foundations*
- *Identify vibration isolation techniques*

P14SC107 ADVANCED CONCRETE TECHNOLOGY LABORATORY

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	3	2

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *The effects of water cement ratio on the influence the behavior of concrete*
- *The effects of aggregate ratio on the influence the behavior of concrete*
- *The correlations between the various strengths are also established*
- *The variance of mix design among various codes*

List of Experiments

1. Study of the effect of water/cement ratio on workability of concrete.
2. Study of the effect of water/cement ratio on strength of concrete.
3. Effect of aggregate/cement ratio on strength of concrete
4. Effect of fine aggregate/coarse aggregate ratio on strength of concrete
5. Correlation between cube strength, cylinder strength.
6. Correlation between split tensile strength and modulus of rupture.
7. Study of Mix design using IS code method.
8. Study of Mix design using ACI method.
9. Non-Destructive testing of concrete
10. Effect of pozzolonic materials on strength of concrete

Text Books:

1. Concrete technology- Neveli – Pearson Publishers, 2000
2. Concrete Technology – M.S. Shetty – S. Chand and Co., 2001

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Understand how water cement ratio influence the behavior of concrete*
- *Understand how water aggregate ratio influence the behavior of concrete*
- *Understand the influence of various parameters on strength of concrete.*
- *Understand variance of mix design among various codes*

P14SC108 COMPUTER AIDED DESIGN LABORATORY

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	3	2

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *Develop programme for analysis of structural elements.*
- *Design various civil engineering basic structural elements.*
- *Apply various software's in civil engineering.*
- *Design special structures.*

List of Experiments

1. Preparing and running complete programs in C for analysis of beams
2. Preparing and running complete programs in C for analysis determinate frames
3. Analysis of concrete elements using STRAP/STAD-PRO.
4. Design of concrete elements using STRAP/STAD-PRO.
5. Analysis of Rolled Steel elements using STRAP/STAD-PRO.
6. Design of Rolled Steel elements using STRAP/STAD-PRO.
7. Exercise on construction engineering and management problems using PRIMA VERA
8. Analysis of structures for moving loads using STRAP/STAD-PRO.
9. Analysis of roof truss using STRAP/STAD-PRO.
10. Analysis of water tanks using STRAP/STAD-PRO.

Text Books:

1. C.S. Krishnamoorthy & S.Rajeev, "*Computer Aided Design*", Narosa Publications.
2. Boyd C. Panbou, "*Computer applications in Construction*", Tata McGraw-Hill Co. Ltd.

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Write a C- programme for analysis of structural elements.*
- *Design basic structural elements.*
- *Various software's in civil engineering.*
- *Special structures manually and using STAAD PRO.*

P14SC109 SEMINAR

Class: M.Tech. I-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	-	2

Examination Scheme:

Continuous Internal Evaluation:	--
End Semester Exam:	100 marks

1 There shall be only Continuous Internal Evaluation (CIE) for Seminar, which includes Report Submission & Presentation

2 A teacher will be allotted to a student for guiding in

(i) selection of topic
(ii) report writing
(iii) Presentation (PPT) before the DPGRC on a pre notified date

COURSE OUTCOMES (CO)	
CO.1	*demonstrate creativity in the design of components, systems or processes of their program of study*
CO.2	*design an innovative product by applying current knowledge and adopt to emerging applications of engineering & technology*
CO.3	*work cooperatively with others to achieve shared goal by motivating team-mates with a clear sense of direction, values and ethics,*
CO.4	*write concisely & convey meaning in a manner appropriate to different readers and verbally express ideas easily understood by others who are unfamiliar with the topic*

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL
DEPARTMENT OF CIVIL ENGINEERING
Scheme of Instruction and Evaluation for Two-Year Postgraduate Programme
M.TECH (STRUCTURAL & CONSTRUCTION ENGINEERING)

SEMESTER – II

Course Code	Course Name	Periods/ Week		Credits	Scheme of Evaluation				
					CIE			ESE	Total Marks
		L	P		TA	MSE	Total		
P14SC201	Theory of Elasticity	3	1	4	15	25	40	60	100
P14SC202	Finite Element Method	3	1	4	15	25	40	60	100
P14SC203	Design Of Concrete Bridges	3	1	4	15	25	40	60	100
P14SC204	Construction Techniques& Equipment	3	1	4	15	25	40	60	100
P14SC205	Elective – III	3	1	4	15	25	40	60	100
P14SC206	Elective – IV	3	1	4	15	25	40	60	100
P14SC207	Design Project Laboratory	-	3	2	40	-	40	60	100
P14SC208	Structural Engineering Laboratory	-	3	2	40	-	40	60	100
P14SC209	Comprehensive Viva-Voce	-	-	2	-	-	-	100	100
	Total	**18**	**12**	**30**	**170**	**150**	**320**	**580**	**900**

Elective – III
P14SC205A. Earthquake Resistant Design of RCC Structures
P14SC205B. Management Information System
P14SC205C. Legal Issues in Construction
P14SC205D. Embankment construction

Elective - IV
P14SC 206A. Quality and Safety Management
P14SC 206B. Construction contracts Management
P14SC 206C. Design of Special Structures
P14SC 206D. Theory of Plates and Shells

P14SC201 THEORY OF ELASTICITY

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam :	60 marks

Course Learning Objectives:

- *Explain the idea of strain and stress tensors, strain deformation relationships for finite and small deformations,*
- *Develop ability to formulate a stress analysis problem in two dimensions and three dimensions based on compatibility conditions, equilibrium equations, and constitutive properties of orthotropic and isotropic elastic materials.*
- *Introduce concept of Airy's stress functions for 2-D plane stress and plane strain problems in Cartesian and cylindrical coordinate systems.*
- *Give an idea about stress concentration, torsion.*

UNIT –I (9+3)

Fundamentals of theory of elasticity:
Definition and notation of stress. Components of stress and strain. Generalized Hooke's law. Stress and strain in three dimensions. Stress components on an oblique plane. Transformation of stress components under change of co-ordinate system.

Analysis of Stress and Strain in Three Dimensions
Principal stresses and principal planes. Stress invariants. Mean and deviator stress. Strain energy per unit volume. Octahedral shear stress. Strain of a line element. Principle strains. Volume strain.

UNIT –II (9+3)

Two Dimensional problems in rectangular coordinates
Plane stress and plane strain situations. Equilibrium equations. Compatibility equations. St. Venant's principle. Uniqueness of solution. Stress components in terms of Airy's stress functions.

Applications of 2 Dimensional problems in rectangular coordinates
Applications to cantilever, simply supported and fixed beams with sample loading.

UNIT –III (9+3)

Two Dimensional Problems in Polar Coordinates
Equilibrium equations. Stress Strain Components. Compatibility equation. Applications using Airy's stress functions in polar co-ordinates for stress distributions symmetric about an axis.

Applications of 2 Dimensional problems in polar coordinates
Effect of hole on stress distribution in a plate in tension. Stresses due to load at a point on a semi-infinite straight boundary. Stresses in a circular disc under diametrical loading

UNIT –IV (9+3)

Torsion

Torsion of various shapes of bars, Stress function method of solution applied to circular and elliptical bars. Prandtl's membrane analogy

Solution to torsion problems in elasticity

Solution of torsion of rectangular bars by (i)Raleigh Ritz method and (ii) Finite difference method.

Text Books:

1. Timoshenko and Goodier, "*Theory of Elasticity*", 3rd Ed., McGraw Hill 2010.
2. C.T. Wang, "*Applied Elasticity*" McGraw Hill,
3. L.S.Srinadh, "*Advanced Mechanics of Solids*" TMH Publishing Company Limited, New Delhi
4 Sadhu Singh, "*Theory of Elasticity*", Khanna Publishers, New Delhi.

Course Learning Outcomes:

After completion of the course, the student will be able to

- *The students will be exposed to the principles of elasticity theory for developing simple and quick estimates of stress and displacement fields for use in elastic stress analysis.*
- *formulate stress analysis problem in two dimensions and three dimensions*
- *There is scope for developing solutions to various stress analysis problems.*
- *The underlying mathematical theory of elasticity provides a rich framework for the study of various applications in practical problems.*

P14SC202 FINITE ELEMENT METHOD

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *To show how the potential energy approach can be used to both derive the stiffness matrix for a spring and solve a spring assemblage problem.*
- *To define symmetry and describe the use of symmetry to solve a problem.*
- *To demonstrate beam analysis using the direct stiffness method.*
- *To drive the axisymmetric element stiffness matrix, body force, and surface traction equations.*

UNIT–I (9+3)

Introduction

Brief History, Introduction to Matrix Notation, Role of the Computer, General Steps of the Finite Element Method, Applications of the Finite Element Method, Advantages of the Finite Element Method.

Introduction to the Stiffness (Displacement) Method

Definition of the Stiffness Matrix, Derivation of the Stiffness Matrix for a Spring Element, Example of a Spring Assemblage, Assembling the Total Stiffness Matrix by Superposition, Boundary Conditions, Potential Energy Approach to Derive Spring Element Equations.

UNIT–II (9+3)

Development of Truss Equations

Derivation of the Stiffness Matrix for a Bar Element in Local Coordinates, Selecting Approximation Functions for Displacements, Transformation of Vectors in Two Dimensions, Global Stiffness Matrix for Bar Arbitrarily Oriented in the Plane, Computation of Stress for a Bar in the x-y Plane, Solution of a Plane Truss, Transformation Matrix and Stiffness Matrix for a Bar in Three-Dimensional Space, Use of Symmetry in Structure, Inclined, or Skewed, Supports.

Application of Truss Equations

Potential Energy Approach to Derive Bar Element Equations, Comparison of Finite Element Solution to Exact Solution for Bar, Galerkin's Residual Method and Its Use to Derive the One-Dimensional Bar Element Equations Other Residual Methods and Their Application to a One-Dimensional Bar Problem.

UNIT–III (9+3)

Development of Beam Equations

Beam Stiffness, Example of Assemblage of Beam Stiffness Matrices, Examples of Beam Analysis Using the Direct Stiffness Method, Distributed Loading, Comparison of the Finite Element Solution to the Exact Solution for a Beam, Potential Energy Approach to Derive Beam Element Equations, Galerkin's Method for Deriving Beam Element Equations.

Frame and Grid Equations
Introduction, Two-Dimensional Arbitrarily Oriented Beam Element, Rigid Plane Frame examples, inclined or Skewed Supports—Frame Element, Grid Equations.

UNIT–IV (9+3)

Development of the Plane Stress and Plane Strain Stiffness Equations
Introduction, Basic Concepts of Plane Stress and Plane Strain, Derivation of the Constant-Strain Triangular Element Stiffness Matrix and Equations, Treatment of Body and Surface Forces, Explicit Expression for the Constant-Strain Triangle Stiffness Matrix Finite Element Solution of a Plane Stress Problem.

Axisymmetric Elements & Isoparametric Formulation
Introduction, Derivation of the Stiffness Matrix, Solution of an Axisymmetric Pressure Vessel, Applications of Axisymmetric Elements, Isoparametric Formulation of the Bar Element Stiffness Matrix, Isoparametric Formulation of the Plane Quadrilateral Element
Stiffness Matrix.

Course Learning Outcomes:
After completion of the course, the student will be able to

- *To assemble stiffness matrices into a global stiffness matrix.*
- *To solve problems with inclined supports.*
- *To derive the stiffness matrix and equation of grid analysis.*
- *To determine the stiffness matrix and stresses for a constant-strain triangle element.*

P14SC203 DESIGN OF CONCRETE BRIDGES

Class: M.Tech. II-Semester **Branch: Structural &Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *Basics of bridge and design loads.*
- *Analyse and design of slab, T - beam bridge and Girder bridges*
- *Design of bridge bearing*
- *Design of piers and abutment.*

UNIT–I (9+3)

Introduction
Types of bridges, materials for construction, codes of practice (Railway and Highway bridges), aesthetics, IRC loading standards.

Hydraulic design
Planning and layout of bridges, hydraulic design, geological and geo-technical considerations,

UNIT-II (9+3)

Slab Bridge
Pigeaud's curves method for design of slab, Analysis of beams– Courbon's Method – Hendry Jaeger Method – Guyon and Massonet Method.

T-Bridge
Design of T-Beam bridge, design of Box Girder Bridges

UNIT-III (9+3)

Bearings
Types and functions of bearings, bearing materials, design of elastomeric bearings,

Bridge Appurtenances
Expansion joints, design of joints railings, drainage system and lighting.,

UNIT-IV (9+3)

Sub - Structure
Loads acting on substructure, design of pier and pier cap, design of shallow and deep foundations

Abutments
Design of caissons, abutments, retaining and wing walls

Text Books:

1. Krishnaraju N, "*Design of Bridges*", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
2. Victor D.J, "*Essentials of Bridge Engineering*", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Jagdish.T.R & Jairam.M.A., "*Design of Bridge Structures*", PHI Learning Pvt. Ltd.
4. Raina V.K., "*Concrete Bridge Practice*", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
5. Swamisaran, "*Analysis and Design of Sub Structures*", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Ponnuswamy S., "*Bridge Engineering*"Tata McGraw Hill Publishing Co. Ltd. New Delhi.
7. Wai-Fah Chen Lian Duan, "*Bridge Engineering Handbook*" CRC Press, USA.

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Classify bridge and loads acting on them*
- *To Design slab, T-beam and Girder bridges*
- *To Design bridge bearings*
- *To Design pies and abutments.*

P14SC204 CONSTRUCTION TECHNIQUES & EQUIPMENTS

Class: M.Tech. Semester: II **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *Acquire knowledge about the prefabrication system in construction practice*
- *Aware of the various construction techniques and the equipment needed for different types of construction activities.*
- *Learn in analyzing the selection and utilization of equipment.*
- *Hosting equipment and conveying equipment*

UNIT-I (9+3)

Pre-cast and Pre-fabricated Construction

Importance of and suitability pre-fabrication,Classification and scope. Advantages and disadvantages of pre-fabrication. Design principles of pre-fabrication system.

Prefabrication systems in residential buildings

Planning and modules and sizes of components in prefabrication, testing of components, Manufacturing and erection guide lines.

UNIT-II (9+3)

Construction equipment

Need for mechanization in construction industry. Financing aspects of construction plants and equipment. Factors effecting selection of construction equipment.

Operating and Maintenance construction equipment

Operating the construction equipment, Equipment Management and maintenance characteristic performance and application to building process for Excavating and demolishing equipment: Shovels, scrapers, bull dozers.

UNIT-III (9+3)

Drilling and Plant Equipments:

Piles and Pile Driving Equipments , Tunnel Boring Machine, Air Compressors, Asphalt Mix Production and Placement

Miscellaneous Equipments:

Compaction and Stabilization Equipments, Trucks and Hauling Equipments, Finishing Equipments, Blasting Rock

UNIT-IV (9+3)

Hoisting equipment

Hoist winch, chains, and hooks, slings, various types of cranes- tower crane, mobile crane and derrick crane. Safety in crane operation.

Conveying equipment
Various types of belts and conveyors. Concreting equipment: Concrete mixers, truck mixers, pneumatic Concrete placers, vibrators and Scaffolding

Text Books:

1. Peurify, R.L. (1996) *"Construction, Planning, equipment and methods"* McGrawHill Book Company, Inc. NY.
2. Mahesh Varma. (1997) *"Construction Equipment, and its planning & Applications"* Metropolitan Book Co. (P) Ltd., New Delhi, India.
3. U.K. Srivastava (1999) *"Construction Planning and Management"* Galgotia Publications Pvt., Ltd., New Delhi, India.
4. *"National building code of India"* BIS 2005

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Selection of appropriate construction equipment to tasks.*
- *Estimate equipment ownership and operating costs.*
- *Estimate and schedule activities using equipment productivity and cost data.*
- *Understand contemporary issues pertaining to construction methods, equipment usage and management.*

P14SC205A EARTHQUAKE RESISTANT DESIGN OF RCC STRUCTURES

M.Tech. Semester: I (Elective-III) Branch: Structural and Construction Engineering

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course learning objectives:

- *To define common terminologies needed for earthquake engineering, name different standards of BIS regarding the earthquake resistant design of structures*
- *Determine the horizontal seismic coefficient, design seismic base shear and distribution of design force,*
- *To explain the need for ductility and ductile detailing of reinforcement in the earthquake resistant design of structures.*
- *To understand the concept of structural and nonstructural unis of a building.*

UNIT-I (9+3)

Engineering seismology

Earthquake phenomenon cause of earthquakes-Faults- plate seismic tectonics- waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales- Energy released-

Earthquake measuring instruments

Seismoscope, Seismograph, Accelerograph- Characteristics of strong ground motions-Seismic zones of India.

UNIT – II (9+3)

Conceptual design

Introduction-Functional planning-continuous load path-overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical tremors-Twisting of building.

Introduction to earthquake resistant design

seismic design requirements-regular and irregular configurations -basic assumptions-design earthquake loads-basic load combinations-equivalent lateral force method- response spectrum method.

UNIT –III (9+3)

Reinforced concrete Buildings

Principles of earthquake resistant deign of RC members- structural models for frame buildings- seismic methods of analysis- seismic design methods- IS code based methods for seismic design- seismic evaluation and retrofitting- Vertical irregularities- plan configuration problems.

Masonry Buildings

Introduction-elastic properties of masonry assemblage- Categories of masonry buildings-Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and

bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings- Load combinations and permissible stresses- seismic design requirements.

UNIT-IV (9+3)

Structural Walls

Strategies in the location of structural walls- sectional shape- variations in elevation- cantilever walls without openings Failure mechanism of non-structures-

Non-structural Elements

Effects of non-structural elements on structural system- Analysis of non- structural elements- prevention of non-structural damage- Isolation of non-structures.

Text Books:

1. *"Earthquake Resistant Design of structures "*- S. K. Duggal, Oxford University Press
2. *"Earthquake Resistant Design of structures"* Pankaj Agawal and Manish Shrikhande, PrenticeHall of India Pvt. Ltd.
3. *"Seismic Design of Reinforced Concrete and Masonry Building"* T Paulay and M.J.N. Priestly, John Wiley & Sons
4. *"Masonry and Timber structures including earthquake Resistant Design"*Anand.S.Arya, Nem Chand &Bros
5. *"Earthquake -Resistant Design of Masonry Building"* Miha Tomazevic, lmperial college Press.
6. *"Earthquake Tips - Learning Earthquake Design and construction"* CVR. Murty

Reference Codes:

1. IS:1893(part-1)-2002"*Criteria for EarthquakeResistant-Designof structures*" BIS., New Delhi.
2. IS:4326-1993, "*Earthquake Resistant Design and Construction of Building*", Code of Practice B.I.S., New Delhi.
3. IS:13920-1993, " *Ductile detailing of concrete structures subjected to seismic force*" Guidelines, B.I.S., New Delhi.

Course student learning outcomes:

After completion of the course, the student will be able to,

- *Memorize thebasic concepts of Earthquake Resistant Design of structures*
- *Can apply the basic principles to design the structural elements in Earthquake resistant design of structures implementing codes for elastic design of structures.*
- *Analyze the ductile detailing of reinforcement in the earthquake resistant design of structures.*
- *Memorize the various strategies in structural and nonstructural component design.*

P14SC205B MANAGEMENT INFORMATION SYSTEMS

Class: M Tech II Semester **Branch: Structural and Construction Engineering**

Teaching Scheme

L	T	P	C
3	1	-	4

Examination Scheme

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *Get exposure to Management Information Systems, Strategic planning and control.*
- *Understanding the methodology for decision making and models associated with it.*
- *Analyze and design various systems of project management.*
- *Understand the concepts relevant to risk and its controlling strategies.*

UNIT- I (9+3)

Introduction

Introduction to management information system – Evaluation of MIS – Manager's view of information – Strategic Planning.

Management Control

Using Information systems for competitive advantage – value chain model – Synergies –core competencies and Network based strategies**.**

UNIT- II (9+3)

Decision making

Decision making and information systems – Simon's model of Decision making.

Optimization of decision making

Criteria for Decision making – Decision support systems and expert systems.

UNIT- III (9+3)

System analysis

Systems analysis and Design structured analysis prototyping system development life cycle feasibility.

Design of the system

Implementation and Evaluation – Systems project Management.

UNIT- IV (9+3)

Security and Ethical issues

Security and Ethical issues in information systems.

Risks analysis

Risk and factors, Risk analysis, controls and threats

Text Books:

1. Robert Schultheis and Mary summer., "*Management Information systems – The Managers view*", Tata Mc GrawHill, 2008
2. Kenneth C Lauden and Jane P Lauden ., "*Management information Systems – Managing the Digital firm*", Pearson education, 2009.
3. Murthy SCV. , "*Management information systems – Text and Applications*" Himalaya publishing house, 2009.
4. Satya Sekhar GV, "*Management information Systems*", Excel books, 2007.

Course Outcomes:

After completion of the course, the student will be able to

- *Discuss Management Information Systems, Strategic planning and control.*
- *Illustrate the methodology for decision making and models associated with it.*
- *Design various systems of project management.*
- *Manage risks and its controlling strategies.*

P14SC205C LEGAL ISSUES IN CONSTRUCTION

Class: M.Tech. II Semester **Branch: Structural and Construction Engineering**

Teaching Scheme

L	T	P	C
3	1	-	4

Examination Scheme

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives: The objectives of the course is to

- *Get exposure to Indian Contract Act, Arbitration and Conciliation Act.*
- *Understand the conditions of contract and its administration.*
- *Understand the contract liability and productivity.*
- *Manage bidding of tenders and documentation.*

UNIT-I (9+3)

Introduction to Law of Contract

Introduction and definition of Contract, Legal issues in contract – Indian contract Act and its provision

Legal Liability

Rights and Duties of Employees, Employers and other stakeholders considering Legal Liability.

UNIT-II (9+3)

Interpretation and conditions

Post contract problems, contract interpretation, concealed conditions, termination of contract, claims and disputes

Contract Administration

Arbitration and settlement of disputes, force majeure, adjudication, arbitration and conciliation Act, alternate dispute resolutions, liquidated damages, actual damages, Risk Management in Construction Industry.

UNIT-III (9+3)

Professional Liability Considerations

Contract Relationship and Liability, Sources of Potential Liability in Construction Industry.

Construction Productivity

Causes for various construction delays, Extension of time (EOT) and non-performance Legal Liability.

UNIT-IV (9+3)

Notice Inviting Tender

Formation of Contract documents, Notice Inviting Tenders (NIT), Prequalification or Pre-evaluation.

Preparing Bidding Documents

Documents forming a contract, notice inviting tenders, types of contracts, stages of awarding contract, basic knowledge on general conditions of Contracts (domestic and FIDIC), importance of standards and codes in contract documents.

Text Books:

1. Patil, B.S., "*Building and Engineering Contracts*" Mrs. S.B. Patil, Pune.
2. Gajerai, G.T., "*Law relating to Building and Engineering Contracts in India*" Butterworths
3. Adrian, J.J., "*Construction Productivity Improvement*", Elsevier, New York
4. Rajan, G.A.N., "*Law of Engineering Contracts (Construction Disputes and Remedies)*", Jain Book Agencies, New Delhi.
5. Roy, P.K., "*Hand book of Construction Management*", McMillan Publishers, New Delhi.
6. Tenah, K.A., "*The Construction Management Process*", Reston Publishing Company, Inc. Virginia
7. Kharb, K.S. "*A Guide to Quantity Surveyors, Engineers Architects and Builders (Vol I: Taking off quantities, Abstracting & Billing; Vol II: Analysis of Prices)*"
8. K.Waker A Teraih and Jose M.Grevarn., "*Fundamentals of Construction Management & Organizations*".
9. Govt of India, Central Public Works Department, "*CPWD 7/8: General Conditions of Contracts.*"
10. "*Professional Liability Considerations in Construction Industry*" published by Cavignac & Associates, 2002

Course Learning Outcomes:

After completion of the course, the student will be able to,

- *Deliberate the sections of Indian Contract Act, Arbitration and Conciliation Act.*
- *Manage the conditions of contract and its administration.*
- *Mitigate the conditions of contract, liability and productivity.*
- *Process bidding of tenders and documentation.*

P14SC205D EMBANKMENT CONSTRUCTION

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *Understand the failures in different types of slopes*
- *Explain about Design and Stability of Slopes*
- *Understand Phenomenon of Landslides and Embankments*
- *Slope stabilizations techniques and design considerations of retaining wall.*

UNIT –I (9+3)

Introduction:

Lateral Supports in Open Cuts, Stability of Hill sides and Slopes in Open Cuts- Causes and General Characteristics of Slope Failure, Engineering Problems Involving the Stability of Slopes. Standard Slopes

Stability of Slopes:

Stability of Slopes and Cuts in Sand, Loess, Clay Containing Layers or Pockets of Water Bearing Sand, Quick Clay Flows, Slides in Soft, stiff clay.

UNIT –II (9+3)

Design and Stability of Embankments:

Design and Stability of Embankments, Modern Practice for Railway and Highway Fills, Levees or Dikes, Types of Base Failures, Methods of Investigating Stability

Embankment Fills

Fills on Very Soft Organic Silt or Clay, Fills on Homogeneous Clay, Varieties of Failure by Spreading.

UNIT –III (9+3)

Landslide phenomenon

Types and causes of slope failures, Practical applications, Stability analysis of infinite slopes with or without water pressures.

Finite and Infinite slopes

Concept of factor of safety, pore pressure coefficients, Mass analysis, Wedge methods, friction circle method; Method of slices, Bishop's method, Janbu's method; Effect of seepage, submerged and sudden draw down conditions.

UNIT –IV (9+3)

Slope Stabilization Techniques

Reinforced Soil, Geosynthetics, Soil Nailing, Influence of Compaction on Rigid Vertical Walls.

Retaining Walls

Retaining walls and their types, Design considerations for Retaining Wall, Causes and Failures of Retaining Walls.

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Text Books:

1. Glen M. Boyce, Lee W. Abramson, Sunil S. Sharma, Thomas S. Lee "*Slope Stability and Stabilization Methods*" ,Willey Inter science publications
2. Gopal Ranjan , "*Soil Mechanics & foundation engineering*", New age publications.
3. C.Venkata Ramaiah ., "*Geotechnical Engineering*", New age publications
4. B.C.Punmia., "*Soil Mechanics & Foundation Engineering*", Laxmi Publications

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Understand the importance of Stability of slope sand embankments.*
- *Able to design of embankment management and retaining walls.*
- *Understand the Phenomenon of Landslides and Embankments*
- *Understand the techniques of slope stabilizations and to know the design considerations of retaining wall.*

P14SC206A QUALITY AND SAFETY MANAGEMENT

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam	60 marks

Course Learning Objectives:

- *To understand the elements of quality planning and the implication*
- *Inculcate the concept of quality and safety and its relation during the construction*
- *Give the concepts of preparation of quality manuals*
- *To understand various considerations involved in structural safety*

UNIT –I (9+3)

Construction Organization

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

Quality Policy

Objectives and methods In Construction Industry -Consumers satisfaction, Economics-Time of Completion -Statistical tolerance -Taguchi's concept of quality -Codes and Standards -Documents -Inspection procedures -Total QA/ QC programme and cost implication.

UNIT –II (9+3)

Quality Assurance and Control

Objectives-Regularity agent-Owner, Design, Contract And Construction Oriented Objectives, Methods-Techniques and Needs Of QA/QC-Different Aspects of Quality-Appraisals, Factors Influencing Construction Quality. Failure aspects-Critical, Major Failure Aspect assurance during construction, Inspection of materials and machinery, Preparation of quality manuals, check list and inspection report.

Quality Management and standards

Concept of quality management in the construction, ISO-9000 Guidelines, Quality standards and / codes in design and construction

UNIT –III (9+3)

Safety strategy

Concept of safety, factors affecting safety- psychological, physiological and technological factors, Planning for safety provisions, Structural safety and its considerations during construction, demolition and during use of equipment. Accidents/injuries and provision of first aid.

Safety recommendations and implementation

Site management with regard to safety recommendations. Training for safety awareness and implementation. Formulation of safety manuals. Safety legislation, standards/codes with

regard to construction. Quality vs. Safety.

UNIT –IV (9+3)

Environmental Safety.

Factors influencing quality of environment and its control, Environmental safety considerations.

Safety Organization

Safety Policy and Record Keeping, Safety Culture-Safe Workers-Practices, Company Activities for enhancing safety-Sub contractual obligation and Safety Procedures, Quality vs safety.

Text Books:

1. Clarkson H. Oglesby,*"Productivity Improvement in Construction"*, McGraw Hill, 2000
2. James, J.O Brian, "*Construction Inspection Handbook – Quality Assurance and Quality Control"* Van Nostrand, New York,1989
3. Juran Frank, J.M. and Gryna, F.M. *"Quality planning and Analysis"*, Tata McGraw Hill, 1982
4. Kwaku A., Tenah and Jose M.Guevera, "*Fundamental of Construction Management and Organization"*, PHI 1995

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Understand the importance of quality management during design and construction phase.*
- *Understand the quality assurance or quality control in the construction activities.*
- *Understand the importance of safety considerations to be made towards environment.*
- *Understand the importance and requirement of safety*

P14SC206B CONSTRUCTION CONTRACTS MANAGEMENT

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme

L	T	P	C
3	1	-	4

Examination Scheme

Continuous Internal Evaluation:	40 Marks
End Semester Exam	60 Marks

Course Learning Objectives:

- *Explain in detail the process of estimation of a project, procedure related to tenders for their execution, contractual conditions applicable, contract administration for successful execution and dispute resolution*
- *Brief into legal issues related to contracts including Contract Act*
- *Explain the process of Arbitration and Conciliation Act.*
- *BOT, DBOT, Insurances and special contract*

UNIT –I (9+3)

Quantity Surveying

Basic principles of estimating, Project cost estimation-preliminary and detailed estimation. Bill of Quantities (BOQ) and specification

Rate Analysis

Principles of rate analysis, direct, indirect cost and overhead charges. Standard methods followed by government and contractors organization

UNIT –II (9+3)

Pre- Tendering

Pre-Qualification of bidders. Tendering and contractual procedures, Indian Contract Act 1872, Definition of Contract and its applicability.

Types of Contract

Documents forming a contract, Types of contracts, international contracts, Conditions and specifications of contract.

UNIT –III (9+3)

Contractual Procedures

Notice Inviting Tenders, Documents forming a contract, Types of contracts, international contracts, Conditions and specifications of contract, Award of contract, various types of bonds/guarantees

Contract Conditions

Important contract clauses. Terms of payments. Retention. Acceptance and final payment. Time of completion. Extension of time. Maintenance period etc

UNIT –IV (9+3)

Claims and Arbitration:

Indian contract act and arbitration act. Variations in work and conditions. Claims and disputes. Liquidated damages. Rights. Responsibilities and duties of client (Owner). Architect. Engineer. Contractor etc.

Insurances & Special Contracts:
Purchase order as contracts insurance and claims, introduction to special contracts-BOT,PPP,DBOT etc.

Text Books:

6. Gajaria G.T., "*Laws Relating to Building and Engineering Contracts in India*", M. M. Tripathi Private Ltd.,Bombay, 1982 Tamilnadu PWD Code, 1986
7. Kharb, K.S. "*A Guide to Quantity Surveyors, Engineers Architects and Builders (Vol I: Taking off quantities, Abstracting & Billing; Vol II: Analysis of Prices)*" Sushila Publications.
8. Jimmie Hinze, "*Construction Contracts*", McGraw Hill, 2001
9. V. K. Raina., "*Construction and Contract Management*" Shroff Publishers
10. B. S Ramaswamy, "*Contracts and their Management*", LexisNexis India (2008)
11. Patil, B.S., "*Building and Engineering Contracts*"
12. Govt of India, Central Public Works Department, Analysis of Rates for Delhi (Vol 1 & 2). and Delhi Schedule of Rates.
13. Govt of India, Central Public Works Department, CPWD 7/8: General Conditions of Contracts.

Course Learning Outcomes:
After completion of the course, the student will be able to
- *Understands the process of estimation of a project, procedure related to tenders for their execution, Contractual conditions applicable, contract administration for successful execution and dispute resolution.*
- *Understand the legal issues related to contracts including Contract Act.*
- *Understand the legal issues related to Arbitration and Conciliation Act.*
- *understand the Insurances and special contract*

P14SC206C DESIGN OF SPECIAL STRUCTURES

M.Tech. Semester: I(Elective-III) **Branch: Structural & Constructional Engineering**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *Study the concept of design of shells and folded plates and Domes and their implementation*
- *Expose the students to various special structures likeChimneys Gantry Girder and Roof trusses and hence design them using I.S Codal provisions*
- *To learn the concept involved in Flat slabs and Grid slabs and their Design.*
- *Study the importance of special structures like Bunkers and Silos and Design according to I.S Codal provisions.*

UNIT – I (9+3)

Shells

Classification of shell structures – Lames Parameters – Gauss – Godazzi relations – Loves first approximation – Design of singly curved shells – Domes.

Folded Plates

Structural behaviour of folded plates – equation of three shears – application of Simpson's and Whitney's methods – Comparison of cylindrical shells with folded plates.

UNIT –II (9+3)

Roof Trusses and Gantry Girder

Analysis and design of Roof Trusses. portal – Gable frames – Design of Gantry Girder

Chimneys

Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

UNIT– III (9+3)

Design of Flat Slabs

Introduction, components, IS code recommendations, Direct design and Equivalent methods, design for flexure and shear.

Grid Slabs

General features, Approximate Method. Plate theory, I.S. code provisions, analysis and design.

UNIT – IV (9+3)

Steel Bunkers And Silos

Design of square bunker – Jansen's and Airy's theories – IS Codal provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – stiffeners.

Text Books:

1. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, "*Design of Steel Structure*", 2nd Edn., Lakshmi Publishers, 1998.
2. Punmia B.C, Ashok Kr. Jain, Arun Kr. Jain, "*RCC Designs (Reinforced Concrete Design"* 10th Edn., Lakshmi Publishers, 2006.
3. Ram Chandra, "*Design of Steel Structures",* 12th Edn., Standard Publishers, 2009.
4. Ramaswamy G. S., "*Design and Construction of concrete shell roofs"*
5. Hendry & Jaeger., "*The analysis of Grid Frames and related structures"*

6.KrishnaRaju N., "*Design of Reinforced concrete Structures"*

7.Arya&Azmani., "*Design of Steel Structures"*

Course student learning outcomes:

After completion of the course, the student will be able to,

- *Understand the importance of Shells and Folded plates and their design applications.*
- *Understand the concept of Flat Slabs and the concepts involved in the Design*
- *Understand the technical importance of Bunkers and silos and their design*
- *Understand the concept of Roof Trusses and Gantry Girders*

P14SC206D THEORY OF PLATES AND SHELLS

Class: M.Tech. I Semester **Branch: Structural & Construction Engg.**

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course learning outcomes:

- *Students comprehend the behaviour of plates and shells under different load cases.*
- *In theory of plates, the students will study the bending theories and energy methods and structural behaviour of plates*
- *In theory of shells, students will understand membrane theory and membrane analysis for shells*
- *Design and detailing of special structures*

UNIT-I (9+3)

Cylindrical Bending

Different kind of plates – Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates withedges simply supported and fixed subjected to uniform load.

Pure Bending of Plates

Slope and curvature of slightly bent plates – Relations Between moments and curvature - Particular cases of pure bending - Strain energy in pure bending

UNIT-II (9+3)

Circular Plates

Symmetrical loading – Relations between slope, deflection, moments and curvature– Governing differential equation – Uniformly loaded plates with clamped and simply supported edges– Central hole – bending by moments and shearing forces uniformly distributed.

Buckling of Plates

Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate

UNIT-III (9+3)

Classification of Shells

Definition and assumptions, Introduction to curved surfaces and classification of shells.

Membrane Analysis

Membrane theory of cylindrical shells and shells of revolution. Axially symmetric bending of shells of revolution.

UNIT-IV (9+3)

Bending Theory of Shells.
Circular Cylindrical shells subjected to Normal Loads, Axissymetrical Bending of circular Cylindrical shells

Special Structures
Design and detailing of folded plates with numerical examples Design and Detailing of simple shell problems – spherical domes, water tanks and barrel vaults.

Text Books:

1. S. Timoshenko and W. Krieger, "*Theory of Plates and Shells*", McGraw Hill
2. Ansel C. Ugural, "*Stresses in Plates and Shells*", McGraw Hill.
3. Zhilun XU, "*Applied Elasticity*", Wiley Eastern Ltd. New Delhi.
4. G. S Ramaswamy, "*Design and Construction of Concrete Shell Roofs*", CBS Publications.
5. Chandrashekhara K., "*Analysis of Concrete Shells*", New Age International Edition.
6. Chandrashekhara K., "*Analysis of Plates*", New Age International Edition.

Course Learning Outcomes:

On completion of this course, students are able to

- *Know the behavior of plates and shells subjected to different load cases.*
- *Get idea on bending theories and governing differential equations for different plates and shells under different loading conditions.*
- *understand membrane theory and analysis for shells*
- *Analyze and design special structures like shell structures like domes, and cylindrical shells*

P14SC207 DESIGN PROJECT LABORATORY

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	3	2

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives:

- *To analyze important structures in civil engineering*
- *To design RCC structures*
- *To design steel chimney*
- *To analyze pre-stressed concrete elements and structures for seismic susceptibility*

List of Experiments

1. Design of Reinforced Cement Concrete Intz Tank.
2. Design of Steel Chimney
3. Design of Reinforced Cement Concrete Folded plate.
4. Design of Reinforced Cement Concrete Shells.
5. Seismic analysis of structures.
6. Design of Reinforced Cement Concrete Deck Slab Bridge.
7. Design of Reinforced Cement Concrete Deck T-Beam Bridge.
8. Design of Box culvert bridge.
9. Analysis and design of pre-stressed concrete elements.
10. Design of roof truss for wind loads.

Text Books:

1. Jain A. K., "*Reinforced Concrete Design*"., Nem Chand Bros. Roorkee.
2. Shah H. J., "*Reinforced Concrete Design*"., Charotar Publications, Anand.
3. Vargeese P.C. "*Limit State Design of Reinforced concrete*", PHI, Limited.
4. Krishna Raju., "*Design of Prestressed concrete members*" Tata McGraw Hill

Course Learning Outcomes:

After completion of the course, the student will be able to

- *To analyze important structures in civil engineering*
- *To design RCC structures*
- *To design steel chimney*
- *To analyze pre-stressed concrete elements and structures for seismic susceptibility*

P14SC208 STRUCTURAL ENGINEERING LABORATORY

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	3	2

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam	60 marks

Course Learning Objectives: ***The objectives of the course is to***

- *Understand the behavior of* Moment-curvature and a/d ratio of beams.
- *Analyze the shear and bond in concrete*
- *Understand the behavior of concrete under torsion*
- *Understand the temperature and size effect of concrete.*

List of Experiments

1. Study on the behaviour of a/d ratio on concrete beams.
2. Moment-curvature behavior of under reinforced beams.
3. Moment-curvature behavior of over reinforced beams.
4. Study the effect of pure shear on concrete.
5. Punching shear resistance of concrete.
6. Tests on bond response of steel and concrete.
7. Effect of cyclic loading on steel.
8. Study of behavior of Beams in Torsion.
9. Effect of temperature on strength of concrete
10. Study on size effect of concrete.

Text Books:

1. Park &Paulay., *"R.C.C. Structures"*
2. Kong and Evans., *"Reinforced and prestressed concrete structures"*

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Illustrate the behavior of* Moment-curvature and a/d ratio of beams.
- *Identify the shear and bond in concrete*
- *Illustrate the behavior of concrete under torsion*
- *Analyze the temperature and size effect of concrete.*

P14SC209 COMPREHENSIVE VIVA-VOCE

Class: M.Tech. II-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	-	2

Examination Scheme:

Continuous Internal Evaluation:	--
End Semester Exam:	100 marks

Course Learning Objectives:

- *Enable the students to understand the philosophies of concrete design*
- *Enable to understand advance design of structures*
- *Enable to understand the various construction techniques*
- *Enable to understand the concept of project management*

There shall be only external oral examination for Comprehensive Viva-voce on a pre-notified date

The oral examination shall cover the entire content of courses covered in First and Second Semesters

Course Learning Outcomes:

After completion of the course, the student will be able to

- *Learn the philosophies of concrete design*
- *Understand advance design of structures*
- *Learn the various construction techniques*
- *Understand the concept of project management*

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL
DEPARTMENT OF CIVIL ENGINEERING
Scheme of Instruction and Evaluation for Two-Year Postgraduate Programme
M.TECH (STRUCTURAL & CONSTRUCTION ENGINEERING)

SEMESTER – III

Course Code	Course Name	Period	Credits	Scheme of Evaluation				
				CIE			ESE	TOTAL MARKS
				TA	MSE	TOTAL		
P14SC 301	Industrial Training	8 Weeks	4	100		100	-	100
P14SC 302	Dissertation	16Weeks	8	100	-	100	-	100
		Total	**12**	**200**	**-**	**200**	**-**	**200**

P14DC301 INDUSTRIAL TRAINING

Class: M.Tech. III-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	-	4

Examination Scheme:

Continuous Internal Evaluation:	100 marks
End Semester Exam:	-

The M.Tech. Coordinator in consultation with the Training & Placement Section has to procure slots for Industrial Training before the last day of instruction of II semester.

The students shall confirm their training slots by the last day of instruction of II semester.

After 8 weeks Industrial Training the students shall submit a certificate and a report in the prescribed format to the department. The Department Post Graduate Review Committee (DPGRC) shall evaluate their submitted reports and oral presentations.

COURSE OUTCOMES (CO)	
CO.1	*demonstrate creativity in the design of components, systems or processes of their program of study*
CO.2	*design an innovative product by applying current knowledge and adopt to emerging applications of engineering & technology*
CO.3	*work cooperatively with others to achieve shared goal by motivating team-mates with a clear sense of direction, values and ethics,*
CO.4	*write concisely & convey meaning in a manner appropriate to different readers and verbally express ideas easily understood by others who are unfamiliar with the topic*

P14DC302 DISSERTATION

Class: M.Tech. III-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	-	8

Examination Scheme:

Continuous Internal Evaluation:	100 marks
End Semester Exam:	-

Registration of Dissertation shall be done within four weeks after completion of the Industrial Training with the supervisor allotted by the department. After the Registration the candidate has to submit and present a brief report focusing the identified topic, literature review, time schedule indicating the main tasks and expected outcome.

Dissertation Seminar-I: At the end of first stage (third semester), student shall submit a progress report to the DPGRC and present the same. The Continuous Internal Evaluation (CIE) for the third semester is done by the DPGRC nominated by the Head of the Department.

COURSE OUTCOMES (CO)	
CO.1	*demonstrate creativity in the design of components, systems or processes of their program of study*
CO.2	*design an innovative product by applying current knowledge and adopt to emerging applications of engineering & technology*
CO.3	*work cooperatively with others to achieve shared goal by motivating team-mates with a clear sense of direction, values and ethics,*
CO.4	*write concisely & convey meaning in a manner appropriate to different readers and verbally express ideas easily understood by others who are unfamiliar with the topic*

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL
DEPARTMENT OF CIVIL ENGINEERING
Scheme of Instruction and Evaluation for Two-Year Postgraduate Programme
M.TECH (STRUCTURAL & CONSTRUCTION ENGINEERING)

SEMESTER – IV

Course Code	Course Name	Period	Credits	Scheme of Evaluation				
				CIE			ESE	TOTAL MARKS
				TA	MSE	TOTAL		
P14SC 401	Dissertation	24 Weeks	12	40	-	40	60	100
Total		**24**	**12**	**40**	**-**	**40**	**60**	**100**

P14DC401 DISSERTATION

Class: M.Tech. IV-Semester **Branch: Structural & Construction Engineering**

Teaching Scheme:

L	T	P	C
-	-	-	12

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Dissertation Seminar-II shall be arranged during the 6th week of IV semester.

Dissertation Seminar-III shall be arranged during the 15th week of IV semester.

Synopsis Seminar shall be arranged two weeks before the final thesis submission date. The student shall submit a synopsis report covering all the details of the works carried out duly signed by the Dissertation Supervisor.

After the synopsis seminar the student is required to submit the dissertation work in bound copies to the department. The Dissertation report shall be evaluated by the DPGRC and external examination shall be conducted on a pre-notified date.

COURSE OUTCOMES (CO)	
CO.1	*demonstrate creativity in the design of components, systems or processes of their program of study*
CO.2	*design an innovative product by applying current knowledge and adopt to emerging applications of engineering & technology*
CO.3	*work cooperatively with others to achieve shared goal by motivating team-mates with a clear sense of direction, values and ethics,*
CO.4	*write concisely & convey meaning in a manner appropriate to different readers and verbally express ideas easily understood by others who are unfamiliar with the topic*