ANNAMALAI UNIVERSITY

WITH COURAGE AND FAITH

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

M.E. (STRUCTURAL ENGINEERING)

Choice Based Credit System

(Full -Time) & (Part -Time)

CURRICULUM AND SYLLABI

BASED ON

R- 2019

MEETING OF BOARD OF STUDIES IN

C & S HELD ON

09.11.2018

DEPARTMENT OF CIVIL & STRUCTURAL ENGINEERING

VISION

To impart high quality education and technical expertise to the students and inculcate in them humanistic attitude, scientific temper, sense of commitment to the profession and spirit of participation in nation building.

MISSION

M1 The ultimate goal of the Department of Civil and Structural Engineering is to provide quality education towards preparing nationally competitive students and trend setters for the future generation in the realm of technical education.

M2 The student should be able to assimilate the available theories, explore new frontiers to propound new theories which will result in improving the quality of life of the people.

M3 To develop their personality in a healthy way and to provide opportunities for acquiring knowledge in state-of-the-art research; and to provide service to the university, engineering profession, and the public through consultancy services.

M4 To provide students with hands on training in latest technologies with supporting softwares.

M5 To facilitate effective interactions among faculty and students and foster networking with alumni, industries and other reputed institutions.

M.E. (STRUCTURAL ENGINEERING)
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the field of Structural Engineering domain feeding the needs of global expectations with professional competence.
PEO2	To enable the graduates to apply sustained learning, their engineering skills and adopting to multidisciplinary situations through graduate work.
PEO3	To expose the students to the latest innovations and trends in the field of Structural Engineering in theory, professional development and self-study in Structural Engineering and Practice and tuning the academic programmes periodically to make the students fit for a professional job, a research assignment or self-employment.
PEO4	To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or in a path to pursue graduate education master and doctoral degree.

PEO5	To produce Structural Engineers who integrate and build on the program's core curricular concepts in the pursuit of professional leadership, teamwork, life-long learning, and successful career advancement.

M.E.(STRUCTURALENGINEERING)-PROGRAMME OUTCOMES (POs)

PO1	**Engineering knowledge:** Apply the knowledge of Civil and Structural Engineering fundamentals to identify, formulate and present solutions to technical problems in their field of expertise.
PO2	**Problem analysis:** Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions using the concepts of that required advanced knowledge within the field.
PO3	**Design / Development of solutions:** Design solutions for Structural engineering related engineering problems and design system components or processes that meet the desired specifications.
PO4	**Conduct investigations: Use** research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid concussions.
PO5	**Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering tools including prediction ad modelling to Structural analysis activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge and impact of Structural systems and engineering solutions to the society and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability: Understand** the sustainability of design commutation systems with respect to environmental and social issues bytheir knowledge of contemporary issues in their expertise.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the structural engineering practice.
PO9	**Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
PO10	**Communication:** Communicate professionally and technically on complex engineering activities with their peer engineering community and society in an effect way, such as, being able to comprehend effective reports and design documents, make effective presentations and make and execute clear instructions.

PO11	**Project management and finance:** Demonstrate the knowledge and understanding of the engineering principles by applying the gained knowledge, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need, adopt themselves for the preparation and ability to engage in independent life-long learning wholly to the demands of the communication and technical changes.

Mapping PO with PEO												
POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEO1	✓				✓	✓			✓			
PEO2		✓		✓		✓						
PEO3		✓	✓		✓					✓		
PEO4			✓				✓		✓			
PEO5			✓	✓			✓				✓	✓

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

M.E. (STRUCTURAL ENGINEERING) - FULL TIME

COURSES OF STUDY AND SCHEME OF EXAMINATIONS

SEMESTER I

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
CZSEPC11	PC - I	Advanced Structural Analysis	3	-	-	25	75	100	3
CZSEPC12	PC - II	Advanced Solid Mechanics	3	-	-	25	75	100	3
CZSEPE13	PE - I	Program Elective – 1	3	-	-	25	75	100	3
CZSEPE14	PE - II	Program Elective – II	3	-	-	25	75	100	3
CZSEMC15	MC	Research Methodology and IPR	2	-		25	75	100	2
CZSECP16	CP- I	Structural Design Lab	-	-	3	40	60	100	2
CZSECP17	CP- II	Advanced Concrete Lab	-	-	3	40	60	100	2
CZSEAC18	Audit 1	Audit Course – 1	-	-	-	-	-	-	-
					Total	**205**	**495**	**700**	**18**

SEMESTER II

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
CZSEPC21	PC - III	FEM in Structural Engineering	3	-	-	25	75	100	3
CZSEPC22	PC - IV	Structural Dynamics	3	-	-	25	75	100	3
CZSEPE23	PE - III	Program Elective – III	3	-	-	25	75	100	3
CZSEPE24	PE - IV	Program Elective – IV	3	-	-	25	75	100	3
CZSECP25	CP - III	Model Testing Lab	-	-	3	40	60	100	2
CZSECP26	CP - IV	Numerical Analysis Lab	-	-	3	40	60	100	2
CZSETS27	TS	Industrial Training & Seminar - Mini Project	-	Tr 2	S 2	40	60	100	2
CZSEAC28	Audit 2	Audit Course -2	-	-	-	-	-	-	-
					Total	**220**	**480**	**700**	**18**

SEMESTER III

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
CZSEPE31	PE - V	Program Elective – V	3	-	-	25	75	100	3
CZSEOE32	OE - II	Open Elective – I	3	-	-	25	75	100	3
CZSEPV33	PV - I	Project work & Viva-voce Phase – I	-	Pr 16	S 4	40	60	100	10
					Total	**90**	**210**	**300**	**16**

SEMESTER IV

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
CZSEPV41	PV - II	Project work & Viva-voce Phase – II	-	Pr 26	S 6	40	60	100	16
					Total	**40**	**60**	**100**	**16**

M.E. (STRUCTURAL ENGINEERING) - PART TIME

SEMESTER I

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full time
PCZSEPC11	PC - I	Advanced Structural Analysis	3	-	-	25	75	100	3	CZSEPC11
PCZSEPC12	PC - II	Advanced Solid Mechanics	3	-	-	25	75	100	3	CZSEPC12
PCZSEMC 13	MC	Research Methodology and IPR	2	-		25	75	100	2	CZSEMC15
PCZSECP14	CP- I	Structural Design Lab	-	-	3	40	60	100	2	CZSECP16
					Total	**115**	**285**	**400**	**10**	

SEMESTER II

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full time
PCZSEPC21	PC - III	FEM in Structural Engineering	3	-	-	25	75	100	3	CZSEPC21
PCZSEPC22	PC- IV	Structural Dynamics	3	-	-	25	75	100	3	CZSEPC22
PCZSECP23	CP - II	Advanced Concrete Lab	-	-	3	40	60	100	2	CZSECP17
PCZSECP24	CP - III	Model Testing Lab	-	-	3	40	60	100	2	CZSECP25
					Total	**130**	**270**	**400**	**10**	

SEMESTER III

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full time
PCZSEPE31	PE- I	Program Elective -1	3	-	-	25	75	100	3	CZSEPE13
PCZSEPE32	PE- II	Program Elective -II	3	-	-	25	75	100	3	CZSEPE14
PCZSEMC33	CP- IV	Numerical Analysis Lab	-	-	3	40	60	100	2	CZSECP26
					Total	**90**	**210**	**300**	**8**	

SEMESTER IV

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full time
PCZSEPE41	PE - III	Program Elective- III	3	-	-	25	75	100	3	CZSEPE23
PCZSEPE42	PE - IV	Program Elective- IV	3	-	-	25	75	100	3	CZSEPE24
PCZSETS43	TS	Industrial Training & Seminar - Mini Project	-	Pr	S	40	60	100	2	CZSETS27
				2	2					
					Total	**90**	**210**	**300**	**8**	

SEMESTER V

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full time
PCZSEPE51	PE - V	Program Elective - V	3	-	-	25	75	100	3	CZSEPE31
PCZSEOE52	OE - II	Open Elective	3	-	-	25	75	100	3	CZSEOE32
PCZSEPV53	PV - I	Project work & Viva-voce Phase- I	-	Pr	S	40	60	100	10	CZSEPV33
				16	4					
					Total	**90**	**210**	**300**	**16**	

SEMESTER VI

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full time
P CZSEPV61	PV - II	Project work & Viva-voce Phase- II	-	Pr	S	40	60	100	16	CZSEPV41
				26	6					
					Total	**40**	**60**	**100**	**16**	

L - Lecture ; P - Practical ; T - Tutorial ; CA - Continuous Assesment ;
FE - Final Examination

Sl.No.	COURSE CODE	LIST OF PROGRAM ELECTIVES	Credits
1.	CZSEPEXX	Theory of Thin Plates and Shells	3
2.	CZSEPEXX	Theory of Application of Cement Composites	3
3.	CZSEPEXX	Theory of Structural Stability	3
4.	CZSEPEXX	Analytical and Numerical Methods for Structural Engineering	3
5.	CZSEPEXX	Structural Health Monitoring	3
6.	CZSEPEXX	Structural Optimization	3
7.	CZSEPEXX	Advanced Steel Design	3
8.	CZSEPEXX	Design of Form work	3
9.	CZSEPEXX	Design of High Rise Structures	3
10.	CZSEPEXX	Design of Masonry Structures	3
11.	CZSEPEXX	Design of Advanced Concrete	3
12.	CZSEPEXX	Advanced Design of Foundations	3
13.	CZSEPEXX	Soil Structure Interaction	3
14.	CZSEPEXX	Design of Industrial Structures	3
15.	CZSEPEXX	Design of Prestressed Concrete Structures	3
16.	CZSEPEXX	Analytical and Finite Element Analysis of Laminated Composite Plates	3
17.	CZSEPEXX	Fracture Mechanics of Concrete Structures	3
18.	CZSEPEXX	Design of Plates and Shells	3

Sl.No.	COURSE CODE	LIST OF OPEN ELECTIVES	Credits
1.	CZSEOEXX	Business Analytics	3
2.	CZSEOEXX	Industrial Safety	3
3.	CZSEOEXX	Operations Research	3
4.	CZSEOEXX	Cost Management of Engineering Projects	3
5.	CZSEOEXX	Composite Materials	3
6.	CZSEOEXX	Waste to Energy	3

Sl.No.	COURSE CODE	LIST OF AUDIT COURSES
1.	CZSEACXX	English for Research Paper Writing
2.	CZSEACXX	Disaster Management
3.	CZSEACXX	Sanskrit for Technical Knowledge
4.	CZSEACXX	Value Addition
5.	CZSEACXX	Constitution of India
6.	CZSEACXX	Pedagogy Studies
7.	CZSEACXX	Stress Management by Yoga
8.	CZSEACXX	Personality Development through Life Enlightenment Skills

CZSEPC11	ADVANCED STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students obtain influence coefficients for hyperstatic structures
- To enable the students apply stiffness method to discrete structures
- To train the students for solving planar structures by member and structure approaches
- To familiarise the students with solving simple boundary value problems
- To provide a basic understanding of the finite element method.

Influence Coefficients

Physical Significance - Effects of Settlements - Temperature Change and Lack of Fit - Member Approach and Structure Approach.

Stiffness Method applied to Large Frames

Local Coordinates and Global Coordinates - Stiffness Matrix Assembly of Structures: Stiffness Matrix in Global Coordinates - Boundary Conditions - Solution of Stiffness Matrix Equations - Calculation of Reactions and Member Forces.

Applications to Simple Problems

Beams - Plane Trusses - Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

Boundary Value Problems (BVP)

Approximate Solution of Boundary Value Problems - Modified Galerkin Method for One-Dimensional BVP - Matrix Formulation of the Modified Galerkin Method.

Linear Element

Shape Functions - Solution for Poisson's Equation - General One Dimensional Equilibrium Problem.

REFERENCES:

1. Weaver. W and Gere. J, Matrix Analysis of Framed Structures, 1990.
2. Lewis P. E. and Ward J.P, The Finite Element Method, Addison-Wesley Publication Co, 1991.
3. Meek J. L., E and FN Computer Methods in Structural Analysis, Span Publication.
4. Desai and Able, The Finite Element Method, , CBS Publication.

COURSE OUTCOMES:

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

1. Obtain influence coefficients for hyperstatic structures
2. Apply stiffness method to discrete structures
3. Analyse planar structures by member and structure approaches
4. Solve simple boundary value problems
5. Understand the basics of finite element method.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√							
CO2		√	√	√						√		
CO3	√	√	√									√
CO4		√										
CO5	√			√				√				

CZSEPC12	ADVANCED SOLID MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamentals of elasticity
- To familiarise the students with the equations of elasticity
- To train the students for solving 2D problems of elasticity
- To enable the students solve torsion problems in bars and thin tubes
- To provide a basic understanding of plasticity

Introduction to Elasticity

Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity. Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

Equations of Elasticity

Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.

Two-Dimensional Problems of Elasticity

Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

Torsion of Prismatic Bars

Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar and Torsion of Thin Tubes.

Plastic Deformation

Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

REFERENCES:

1. Timoshenko S. And Goodier J. N., Theory of Elasticity, McGraw Hill, 1961.
2. Sadd M.H., Elasticity, Elsevier, 2005.
3. Ragab A. R., Bayoumi S.E., Engineering Solid Mechanics, CRC Press, 1999.
4. Ameen M., Computational Elasticity, Narosa, 2005.

5. Kazimi S. M. A., Solid Mechanics, Tata McGraw Hill, 1994.
6. Srinath L.S., Advanced Mechanics of Solids, Tata McGraw Hill, 2000.

COURSE OUTCOMES:

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

1. Understand the fundamentals of elasticity
2. Apply the equations of elasticity
3. Solve 2D problems of elasticity
4. Solve torsion problems in bars and thin tubes
5. Understand the basics of plasticity.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√							
CO2		√		√						√		
CO3	√		√			√						√
CO4		√										
CO5	√			√				√				√

CZSEMC15	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES:

- To train the students towards identifying research problems
- To familiarise the students with technical paper and research proposal writing
- To familiarise the students with patenting
- To make the students understand the patent rights
- To familiarise the students with new developments in IPR

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Nature of Intellectual Property: Patents, Designs, Trade and Copyright - Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
3. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
4. Mayall , "Industrial Design", McGraw Hill, 1992.
5. Niebel , "Product Design", McGraw Hill, 1974.
6. Asimov, "Introduction to Design", Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
8. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

COURSE OUTCOMES:

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

1. Identify good research problems
2. Write sound technical papers and research proposals
3. Understand the concepts of patenting
4. Understand the patent rights
5. Utilise the new developments in IPR

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					√
CO2				√						√		
CO3			√			√						√
CO4												
CO5	√			√				√				√

CZSECP 16	**STRUCTURAL DESIGN LAB**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**2**

COURSE OBJECTIVES:

- To introduce the fundamentals of structural analysis, design and detailing
- To familiarise the students with the analysis of symmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software

- To familiarise the students with the analysis of unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software
- To familiarise the students with the analysis of symmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software
- To familiarise the students with the analysis of unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software

LIST OF EXPERIMENTS:

1. Analysis of Symmetrical Building Frames (Gravity load only) uses STADD PRO Software.
2. Analysis of Symmetrical Building Frames (Wind load only) using STADD PRO Software.
3. Analysis of Symmetrical Building Frames (Earthquake load only) using STADD PRO Software.
4. Analysis of Un-Symmetrical Building Frames (Gravity load only) using STADD PRO Software.
5. Analysis of Un-Symmetrical Building Frames (Wind load only) using STADD PRO Software.
6. Analysis of Un-Symmetrical Building Frames (Earthquake load only) using STADD PRO Software.
7. Analysis of Symmetrical Building Frames (Gravity load only) using Etabs Software.
8. Analysis of Symmetrical Building Frames (Wind load only) using Etabs Software.
9. Analysis of Symmetrical Building Frames (Earthquake load only) using Etabs Software.
10. Analysis of Un-Symmetrical Building Frames (Gravity load only) using Etabs Software.
11. Analysis of Un-Symmetrical Building Frames (Wind load only) using Etabs Software.
12. Analysis of Un-Symmetrical Building Frames (Earthquake load only) using Etabs Software.

REFERENCES:

1. Unnikrishnan Pillai, S. and Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill Publications, New Delhi, 1988.
2. IS 13920:1993, Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces, BIS, New Delhi.
3. SP 34:1987, Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi.
4. STADD PRO Software Working Manual.
5. ETABS Software Working Manual.

COURSE OUTCOMES:

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

1. Understand the codal provisions relating to structural design and detailing.
2. Analyse symmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
3. Analyse unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
4. Analyse symmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.
5. Analyse unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					√
CO2				√						√		
CO3		√				√						√
CO4												
CO5		√		√				√				√

CZSECP 17	ADVANCED CONCRETE LAB	L	T	P	C
		3	0	0	2

COURSE OBJECTIVES:

- To introduce the fundamentals of concrete mix design
- To familiarise the students with Stress - Strain Curves for concrete and Reinforcing Steel
- To make the students understand the flexural behaviour of RC Beams
- To make the students understand the shear behaviour of RC beams
- To familiarise the students with non-destructive testing on concrete elements

LIST OF EXPERIMENTS

1. Concrete Mix Design - IS and ACI Methods
2. Study of Stress - Strain Curve for concrete
3. Study of Stress - Strain Curve for Reinforcing Steel
4. Flexure Test on RC Beam
5. Shear Test on RC Beam
6. Study on Rolled Steel Joist
7. Bending Test on Steel Flat
8. Non-destructive Testing

REFERENCES:

1. Neville, A.M., Properties of Concrete, Prentice Hall, 2012
2. Unnikrishnan Pillai, S. and Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill Publications, New Delhi, 1988
3. IS 10262:2019, Recommended Guidelines for Concrete Mix Design, BIS, New Delhi
4. IS 13920:1993, Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces, BIS, New Delhi
5. SP 34:1987, Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi.

COURSE OUTCOMES:

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

1. Understand the fundamentals of concrete mix design
2. Design concrete mixes using national and international codes of practice

3. Understand the flexural behaviour of RC beams
4. Understand the shear behaviour of RC beams
5. Conduct non-destructive testing on concrete elements.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					√
CO2				√						√		
CO3		√				√						√
CO4												
CO5		√		√				√				√

CZSEPE 21	FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamentals of numerical methods
- To familiarise the students with Eigen vale problems
- To train the students for solving ordinary and partial differential equations
- To provide the students with a background of finite difference scheme
- To enable the students write computer programs for solving mathematical problems

Introduction

History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, and Nodal Equilibrium equations, assembly of Global Stiffness Matrix, Element Strain and Stress.

Beam Elements

Flexure Element, Element Stiffness Matrix, Element Load Vector.

Method of Weighted Residuals

Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications - Types: Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.

Application to Solid Mechanics

Plane Stress, CST Element, Plane Strain Rectangular Element, Iso-parametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.

Computer Implementation of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

REFERENCES:

1. Seshu P., Finite Element Analysis, Prentice-Hall of India, 2005.
2. Cook R. D., Wiley J., Concepts and Applications of Finite Element Analysis, New York, 1995.
3. Hutton David, Fundamentals of Finite Element Analysis, Mc-Graw Hill, 2004.
4. Buchanan G.R., Finite Element Analysis, McGraw Hill Publications, New York, 1995.
5. Zienkiewicz O.C. & Taylor R.L. Finite Element Method, Vol. I, II & III, Elsevier, 2000.

COURSE OUTCOMES:

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

1. Understand the fundamentals of numerical methods
2. Solve Eigen Value problems
3. Solve ordinary and partial differential equations
4. Understand the finite difference schemes
5. Solve numerically different structural problems

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√							
CO2		√	√	√						√		
CO3	√	√	√									√
CO4		√										
CO5	√			√				√				

CZSEPC22	**STRUCTURAL DYNAMICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To provide an information about Vibration Analysis and Mathematical Modeling.
- To know about numerical solution and its methods.
- To study about dynamics response of SDOF system using fundamental theory and equation of motion.
- To study about dynamics response of MDOF system using fundamental theory and equation of motion.
- To learn about the available software for dynamic analysis.

Introduction

Objectives, Importance of Vibration Analysis, Nature of Exciting - Forces, Mathematical Modeling of Dynamic Systems - Single Degree of Freedom System:Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier analysis for Periodic Loading, State Space Solution for Response.

Numerical Solution

Response using New mark _ Method and Wilson _ Method, Numerical Solution for State Space Response using Direct Integration.

Multiple Degree of Freedom System (Lumped parameter)

Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

Multiple Degree of Freedom System (Distributed Mass and Load)

Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.

Special Topics in Structural Dynamics (Concepts only)

Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.

REFERENCES:

1. Clough R. W. and Penzien J., Dynamics of Structures, , McGraw Hill, 1993.
2. Chopra A.K., Structural Dynamics and Introduction to Earthquake Engineering, 1998.
3. Smith J. W., Vibration of Structures - Application in Civil Engineering Design, Chapman and Hall.
4. Humar J. L., Dynamics of Structures, Prentice Hall,1989.
5. Paz Mario, Structural Dynamics - Theory and Computation, CBS Publication.
6. Hart and Wong, Dynamics of Structures,.

COURSE OUTCOMES:

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

1. Understand vibration Analysis and Mathematical Modeling.
2. Evaluate numerical solution and its methods.
3. Analyze dynamics response of SDOF system using fundamental theoryand equation of motion.
4. Analyze dynamics response of MDOF system using fundamental theory and equation of motion.
5. Use the available software for dynamic analysis.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√			√				√
CO2		√	√	√						√		
CO3	√	√	√									√
CO4		√	√							√		
CO5	√			√				√				

CZSECP26	MODEL TESTING LAB	L	T	P	C
		0	2	2	2

COURSE OBJECTIVES:

- To learn about response of structures
- To prepare a model for testing
- To test structural models under static condition.
- To test structural models under dynamic condition.
- To evaluate dynamic modulus

LIST 0F EXPERIMENTS:

1. Model Analysis – Continuous beam.
2. Model Analysis – Portal frame.
3. Model Analysis –Plate.
4. Free vibration analysis of wooden cantilever beam model.
5. Free vibration analysis of steel cantilever beam model.
6. Free vibration analysis of aluminum cantilever beam model.
7. Free vibration analysis of glass cantilever beam model.
8. Determination of viscous damping co-efficient for wooden beam model.
9. Determination of viscous damping co-efficient for steel beam model.
10. Determination of viscous damping co-efficient for aluminum beam model.
11. Determination of viscous damping co-efficient for glass beam model.
12. Free vibration Analysis of Simply Supported Steel Beam model.
13. Forced vibration Analysis of Simply Supported Steel Beam model.

COURSE OUTCOMES:

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

1. Understand the response of structures.
2. Prepare the models.
3. Conduct model testing for static loading
4. Conduct model testing for free and forced vibrations
5. Evaluation of dynamic modulus

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					√
CO2				√						√		
CO3			√			√						√
CO4												
CO5	√			√				√				√

CZSETS27	INDUSTRIL TRAINING & SEMINAR - MINI PROJECT	L	Tr	S	C
		0	2	2	2

COURSE OBJECTIVES:

1. To determine structural engineering problems reviewing available literature.
2. To Study about different techniques used to analyze complex structural systems.
3. To compare the solutions given and present solution by using his/her technique applying engineering principles.
4. To Understand of contemporary / emerging technology.

Share knowledge effectively in oral and written form and formulate documentsThe students will individually undertake a training program in reputed concerns in the field of structural engineering field during vacation period for a minimum stipulated period of four weeks. At the end of the commencement of the third semester for Full Time / fifth semester for Part Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

COURSE OUTCOMES:

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

1. Identify structural engineering problems reviewing available literature.
2. Study different techniques used to analyze complex structural systems.
3. Work on the solutions given and present solution by using his/her technique applying engineering principles.
4. Understand of contemporary / emerging technology.
5. Share knowledge effectively in oral and written form and formulate documents.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√			√				√
CO2		√	√	√						√		
CO3	√	√	√									√
CO4		√	√							√		
CO5	√			√				√				√

CZSEPV33	PROJECT WORK AND VIVA-VOCE PHASE - I	L	Pr	S	C
		0	16	4	10

COURSE OBJECTIVES:

- To prepare the final report of project work in standard format.
- To use knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- To learn about different methodologies, methods and forms of analysis to produce a suitable research design and justify their design..
- To manipulate the findings of their technical solution in a written report.
- To present the work in International/National conference or reputed journals.

The students will individually undertake a research problems in the field of Structural Engineering in the third semester for Full Time / Fifth semester for Part Tim. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of the third semester for Full Time / fifth semester for Part Time.. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva- voce examination.

COURSE OUTCOMES:

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

1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Select a technique from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
4. Present the findings of their technical solution in a written report.
5. Make the presentation of their work in International/National conference or reputed journals.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					√
CO2				√						√		
CO3		√				√						√
CO4												
CO5		√		√				√				√

CZSEPV41	PROJECT WORK AND VIVA-VOCE PHASE- II	L	Pr	S	C
		0	24	6	15

COURSE OBJECTIVES:

- To prepare the final report of project work in standard format.
- To use knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- To learn about different methodologies, methods and forms of analysis to produce a suitable research design and justify their design..
- To manipulate the findings of their technical solution in a written report.
- To present the work in International/National conference or reputed journals.

The students will individually undertake research problems in the field of Structural Engineering in the fourth semester for Full Time / sixth semester for Part Tim. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of the fourth semester for Full Time / sixth semester for Part Time.. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva- voce examination.

COURSE OUTCOMES:

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

1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Select a technique from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design..
4. Present the findings of their technical solution in a written report.
5. Make the presentation of their work in International/National conference or reputed journals.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					√
CO2				√						√		
CO3		√				√						√
CO4												
CO5		√		√				√				√

PROGRAM ELECTIVES

CZSEPEXX	THEORY OF THIN PLATES AND SHELLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide students with a rational basis for the analysis and design of thin plates.
- To provide students with a rational basis for the analysis and design of thin shells.

Introduction:

Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

Static Analysis of Plates:

Governing Equation for a Rectangular Plate, Navier Solution for simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

Circular Plates:

Analysis under Axi- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.

Static Analysis of Shells:

Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells,

Shells of Revolution:

with Bending Resistance- Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels - Thermal Stresses in Plate/ Shell

REFERENCES:

1. Timoshenko S. and Krieger W., Theory of Plates and Shells, McGraw Hill, 2010.
2. Ugural Ansel C., Stresses in Plates and Shells, McGraw Hill.
3. Kraus H., Thin Elastic Shells, John Wiley and Sons.
4. Chandra shekhara K., Theory of Plates, Universities Press.
5. Ramaswamy G.S., Design and Construction of Concrete Shell roofs, Malabar, USA, 1984.

COURSE OUTCOMES:

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

1. Understand the basic concept of plates and shells.
2. Use analytical methods for the solution of thin plates.
3. Use analytical methods for the solution of shells.
4. Apply the numerical techniques and tools for the complex problems in thin plates.
5. Apply the numerical techniques and tools for the complex problems in shells.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					
CO2				√						√		
CO3		√				√						
CO4	√	√			√							
CO5		√		√				√				

CZSEPEXX	THEORY AND APPLICATIONS OF CEMENT COMPOSITES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarize the students with the mechanical properties and application of cement composites.
- To obtain the students for analysis and designing cement composite structural elements.

Introduction:

Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. 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 Behaviour:

Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

Cement Composites:

Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete – Ferro-cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

Mechanical Properties of Cement Composites:

Behavior of Ferro-cement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

Application of Cement Composites:

FRC and Ferro-cement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants - Analysis and Design of Cement Composite Structural Elements: Ferro-cement, SIFCON and Fibre Reinforced Concrete.

REFERENCES:

1. Jones R. M,, Mechanics of Composite Materials, 2nd Ed., Taylor and Francis, BSP Books, 1998.
2. Pama R. P., Ferro-cement – Theory and Applications, IFIC, 1980.
3. Swamy R.N.,New Concrete Materials, 1stEd., Blackie, Academic and Professional, Chapman &Hall, 1983.

COURSE OUTCOMES:

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

1. Formulate constitutive behaviour of composite materials – Ferro-cement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour.
2. Classify the materials as per orthotropic and anisotropic behaviour.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyse and design structural elements made of cement composites.
5. Gain the knowledge about composite materials.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√		√		√		√					
CO2				√						√		
CO3		√				√						
CO4	√		√									
CO5		√		√				√				√

CZSEPEXX	THEORY OF STRUCTURAL STABILITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge regarding the stability analysis of columns and frames.
- To make the students understand the concept of inelastic stability.

Criteria for Design of Structures:

Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.

Stability of Columns:

Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

Stability of Frames:

Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

Stability of Beams: lateral torsion buckling.

Stability of Plates:

Axial flexural buckling, shear flexural buckling, buckling under combined loads - Introduction to Inelastic Buckling and Dynamic Stability.

REFERENCES:

1. Timoshenko and Gere, Theory of elastic stability, Tata McGraw Hill,1981
2. Alexander Chajes, Principles of Structural Stability Theory, Prentice Hall, New Jersey.
3. Iyengar, N. G. R., Structural Stability of columns and plates, Eastern west press Pvt. Ltd.
4. Bleich F. Bucking, Strength of Metal Structures, Tata McGraw Hill, New York.

COURSE OUTCOMES:

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

1. Understand the criteria for design of structures.
2. Determine stability of columns.
3. Determine stability of frames.
4. Determine stability of beams and plates
5. Use stability criteria and concepts for analysing discrete and continuous systems.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					√
CO2				√						√		
CO3		√				√						
CO4												
CO5		√		√				√				

CZSEPEXX	**ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To familiarise the students with numerical methods applicable to structural engineering problems.
- To train them for writing computer programs for solving a mathematical problems.

Fundamentals of Numerical Methods:

Error Analysis, Polynomial Approximations and Interpolations, Curve Fitting**;** Interpolation and extrapolation.

Solution of Nonlinear Algebraic and Transcendental Equations –

Elements of Matrix Algebra: Solution of Systems of Linear Equations, Eigen Value Problems.

Numerical Differentiation & Integration:

Solution of Ordinary and Partial Differential Equations.

Finite Difference scheme: Implicit & Explicit scheme.

Computer Algorithms:

Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

REFERENCES:

1. Atkinson K.E., An Introduction to Numerical Analysis, Wiley and Sons, 1989.
2. Scheid F, Theory and Problems of Numerical Analysis, McGraw Hill Book Company, (Shaum Series), 1988.
3. Sastry S. S, Introductory Methods of Numerical Analysis, Prentice Hall of India, 1998.

COURSE OUTCOMES:

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

1. Solve ordinary and partial differential equations in structural mechanics using numerical methods.
2. Gain the knowledge about the solution of nonlinear equations.
3. Understand the solution of differential equations.
4. Solve the problems using finite difference scheme.
5. Write a program to solve a mathematical problem using software.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2		√		√						√		
CO3		√				√						
CO4			√									
CO5		√		√				√				

CZSEPEXX	**STRUCTURAL HEALTH MONITORING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To make the students understand the importance of SHM.
- To introduce various testing procedures and repair strategies.

Structural Health:

Factors affecting Health of Structures, Causes of Distress and Regular Maintenance - Structural Health Monitoring: Concepts, Various Measures, and Structural Safety in Alteration.

Structural Audit:

Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

Static Field Testing:

Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

Dynamic Field Testing:

Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

Introduction to Repairs and Rehabilitations of Structures:

Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

REFERENCES:

1. Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, John Wiley and Sons, 2006.
2. Douglas E Adams, John Wiley and Sons, Health Monitoring of Structural Materials and Components Methods with Applications, , 2007.
3. Vol1, J. P. Ou, H. Li and Z. D. Duan, Structural Health Monitoring and Intelligent Infrastructure, Taylor and Francis Group, London, UK, 2006.
4. Victor Giurglutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.

COURSE OUTCOMES:

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

1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Suggest repairs and rehabilitation measures of the structure
5. Understand the structures monitoring based on strength using different types of methods.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					√
CO2			√	√						√		
CO3		√				√						
CO4			√									
CO5		√		√				√				

CZSEPEXX	**STRUCTURAL OPTIMIZATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To provide the basic knowledge regarding linear optimization methods.
- To provide the basic knowledge regarding non - linear optimization methods.

Introduction: Simultaneous Failure Mode and Design, Classical External Problems.

Calculus of Variation: Variational Principles with Constraints,

Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,

Geometric Programming **and** Stochastic Programming.
Applications: Structural Steel and Concrete Members, Trusses and Frames - Design:Frequency Constraint, Design of Layouts.

REFERENCES:

1. Haftka, Raphael T., Gürdal, Zafer,Elements of Structural Optimization, Springer.
2. Cherkaev Andrej, Variational methods for Structural optimization, Springer

COURSE OUTCOMES:

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

1. Solve the classical external problems
2. Use Variational principle for optimization
3. Develop the linear programming
4. Apply optimization techniques to structural steel and concrete members.
5. Design using frequency constraint.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2			√	√						√		
CO3		√				√						
CO4												
CO5		√		√				√				√

CZSEPEXX	**ADVANCED STEEL DESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To enable the students design of steel structures.
- To make the students understand height concept of stability.

Properties of Steel:

Mechanical Properties, Hysteresis, Ductility- Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.

Design of Steel Structures:

Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift.

Stability of Beams:

Local Buckling of Compression Flange &Web, Lateral Torsional Buckling -Stability of Columns: Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.

Method of Designs:

Allowable Stress Design, Plastic Design, Load and Resistance Factor Design; Strength Criteria: Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.

Connections:

Welded, Bolted, Location Beam Column, Column Foundation, Splices.

REFERENCES:

1. Ramchandra. Design of Steel Structures - Vol. II, Standard Book House, Delhi.
2. Arya A. S., Ajmani J. L., Design of Steel Structures - Nemchand and Bros., Roorkee.
3. Baker J. F., Horne M. R., HeymanJ. The Steel Skeleton- Vol. II, Plastic Behaviour and Design -, ELBS.
4. Neal B. G., Plastic Methods of Structural Analysis, Chapman and Hall London.
5. IS 800: 2007 – General Construction in Steel - Code of Practice?
6. SP – 6 - Handbook of Structural Steel Detailing, BIS,1987

COURSE OUTCOMES:

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

1. Understand the knowledge about properties of steel
2. Design steel structures/ components by different design processes.
3. Analyze the beams and columns for stability and strength, and drift.
4. Understand the design of beams.
5. Design welded and bolted connections.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2			√	√						√		
CO3		√				√						
CO4			√									√
CO5	√	√		√				√				

CZSEPEXX	**DESIGN OF FORMWORK**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To provide the basic concepts understand the design of form work.
- To familiarise the students with deferent types of form work.

Introduction:

Requirements and Selection of Formwork - Formwork Materials- Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

Formwork Design:

Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

Formwork Design for Special Structures:

Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

Flying Formwork:

Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.

Formwork Failures:

Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

REFERENCES:

1. Peurify, Formwork for Concrete Structures, McGraw Hill India, 2015.
2. Kumar Neeraj Jha, Formwork for Concrete Structures, Tata McGraw Hill Education, 2012.
3. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

COURSE OUTCOMES:

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

1. Select proper formwork, accessories and material.
2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
3. Design the form work for Special Structures.
4. Understand the working of flying formwork.
5. Judge the formwork failures through case studies.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2				√						√		√
CO3		√				√						
CO4												
CO5		√		√				√				

CZSEPEXX	DESIGN OF HIGH RISE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students understand the design procedure for towers and chimneys.
- To provide the fundamental information pertinent to tall buildings.

Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

Tall Buildings:Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions.

Firefighting:Design provisions.

Application of software in analysis and design.

REFERENCES:

1. Varyani U. H., Structural Design of Multi-storyed Buildings, 2nd Ed., South Asian Publishers, New Delhi, 2002.
2. Taranath B. S., Structural Analysis and Design of Tall Buildings, McGraw Hill, 1988.
3. Shah V. L. & Karve S. R., Illustrated Design of Reinforced Concrete Buildings (GF+3storeyedStructures Publications, Pune, 2013.
4. Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.
5. Smith Byran S. and Coull Alex, Tall Building Structures, Wiley India. 1991.
6. Wolfgang Schueller, High Rise Building Structures, Wiley. 1971.
7. Manohar S. N., Tall Chimneys, Tata McGraw Hill Publishing Company, New Delhi

COURSE OUTCOMES:

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

1. Analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.
2. Analyse, design and detail the RC and Steel Chimney.
3. Analyse, design and detail the tall buildings subjected to different loading conditions using relevant codes.
4. Design and detail the tall buildings subjected to firefighting provision using relevant codes.
5. Analyse and design the tall buildings using relevant software.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					
CO2				√						√		
CO3		√				√						
CO4												
CO5		√		√				√				

CZSEPEXX	DESIGN OF MASONRY STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarise the students with design approaches to masonry structures.
- To enable the students analyse reinforced masonry members.

Introduction:

Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

Flexural Strength of Reinforced Masonry Members:

In plane and Out-of-plane loading - Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation.

Shear Strength and Ductility of Reinforced Masonry Members.

Prestressed Masonry:

Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

Elastic and Inelastic Analysis, Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra.

REFERENCES:

1. Narendra Taly, Design of Reinforced Masonry Structures, ICC, 2nd Edn,
2. Hamid Ahmad A. and Drysdale Robert G., Masonry Structures: Behavior and Design, 1994.
3. Maurizio Angelillo, Mechanics of Masonry Structures, 2014.
4. Toma_evi_Miha, Earthquake-resistant Design of Masonry Buildings, Imperial College Press, 1999.

COURSE OUTCOMES:

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

1. Understand the masonry design approaches.
2. Analyse Reinforced Masonry Members.
3. Determine interactions between members.
4. Determine shear strength and ductility of Reinforced Masonry members.
5. Check the stability of walls and Perform elastic and inelastic analysis of walls.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					√
CO2		√		√						√		
CO3		√				√						
CO4		√	√									
CO5		√		√				√				

CZSEPEXX	DESIGN OF ADVANCED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge on the design of shear wall structures.
- To familiarise the students with national and international code provisions.

Deflection and crack width – estimation based on IS 456, BS 8110, EC and ACI method.
Redistribution of moments in RC beams – Condition for moment redistribution – moment redistribution in fixed beam and two span continuous beam – Advantages
Design of deep beams, spandrel beams – Analysis of grid floors.
Analysis, design and detailing of shear walls.
Machine foundations – Types – General requirements – Design parameters – Design criteria and Codal provisions for reciprocating and Rotary type machines.

REFERENCES:

1. Pillai S. U. and Menon D., Reinforced Concrete Design, Tata McGraw-Hill, 3rd Ed, 1999.
2. Subramaniam N., Design of Steel Structures, Oxford University Press, 2008.
3. Park R. and Paulay T. , Reinforced Concrete Structures, John Wiley & Sons, 1995.
4. Varghese P. C., Advanced Reinforced Concrete Design, Prentice Hall of India, New Delhi.
5. Hsu T. T. C. and Mo Y. L., Unified Theory of Concrete Structures, John Wiley &Sons, 2010.
6. Salmon C. G., Johnson J. E. and Malhas F. A., Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design, Pearson Education, 5th Ed, 2009.
7. Ramchandra, Design of Steel Structures - Vol. II,. Standard Book House, Delhi.

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COURSE OUTCOMES:

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

1. Determine the deflection and crack width of flexural members using code provisions.
2. Understand the redistribution moments in R. C. Beams.
3. Design the deep beams as per relevant codes.
4. Analyse the special structures by understanding their behaviour.
5. Design and prepare detail structural drawings for execution citing relevant IS codes.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					
CO2		√	√	√						√		
CO3		√				√						
CO4			√									
CO5		√						√				

CZSEPEXX	ADVANCED DESIGN OF FOUNDATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide the knowledge relating to shallow foundations.
- To enable the students analyse and design deep foundations.

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings along with Various Penetration Tests.

Shallow Foundations, Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

Pile Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.

Well Foundation, IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods – Tunnels and Arching in Soils, Pressure Computations around Tunnels.

Open Cuts, Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types - Coffer Dams, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

REFERENCE BOOKS:

1. N.P. Kurian, Design of foundation system, Narosa Publishing House
2. J. E. Bowles, Foundation Analysis and Design, Tata McGraw Hill New York
3. Sawmi Saran, Analysis and Design of Substructures, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

COURSE OUTCOMES:

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

1. Understand the knowledge about planning of soil exploration.
2. Design the shallow foundations for construction engineering structures
3. Design the pile foundations for construction engineering structure
4. Design the well foundations for construction engineering structures
5. Understand the knowledge about open cuts in different soils.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√			√		√					
CO2			√	√						√		
CO3		√	√			√						
CO4			√									
CO5		√	√	√				√				

CZSEPEXX	SOIL STRUCTURE INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide the basic concepts underlying soil structure interaction.
- To enable the students evaluate soil structure interaction for different types of structures.

Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction - application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.

Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.

Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pull-out Resistance.

REFERENCES:

1. Bowels J.E., Analytical and Computer Methods in Foundation, McGraw Hill Book Co., New York, 1974.
2. Desai C.S. and Christian J.T., Numerical Methods in Geotechnical Engineering, McGraw Hill Book Co., New York.
3. Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers.
4. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.
5. Selvadurai A.P.S., Elastic Analysis of Soil-Foundation Interaction, Elsevier Scientific Publishing Company.
6. Swami Saran, Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.
7. Kurian N. P., Design of Foundation System- Principles & Practices, Narosa Publishing

COURSE OUTCOMES:

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

1. Understand soil structure interaction concept and complexities involved.
2. Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.
3. Prepare comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.
4. Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.
5. Evaluate action of group of piles considering stress-strain characteristics of real soils.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					
CO2				√						√		√
CO3		√				√						
CO4												
CO5		√		√		√		√				

CZSEPEXX	DESIGN OF INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide design procedures for steel portal and gable frames.
- To provide design procedures for chimneys and storage structures.

Steel Gantry Girders

Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure - Portal Frames– Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures

Steel Bunkers and Silos

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

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.

Water Tanks

Design of rectangular riveted steel water tank – Tee covers – Plates – Stays –Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchor bolts.

Design of prestressed steel water tank

Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder –Design of staging and foundation.

REFERENCES:

1. Punmia B. C., Jain Ashok Kr., Jain Arun Kr Design of Steel Structure, 2nd Ed., Lakshmi Publishers, 1998.
2. Ram Chandra, Design of Steel Structures, 12th Ed., Standard Publishers, 2009.
3. Subramanian, Design of Steel Structures.

COURSE OUTCOMES:

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

1. Design Steel Gantry Girders.
2. Design Steel Portal, Gable Frames.
3. Design Steel Bunkers and Silos.
4. Design Chimneys and Water Tanks.
5. Design prestressed steel water tank.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2		√		√						√		
CO3		√				√						
CO4	√											√
CO5		√		√				√				

CZSEPEXX	**DESIGN OF PRESTRESSED CONCRETE STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To train the students for analysing PSC members.
- To train the students for designing PSC members.

Introduction to prestressed concrete: Types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.

Statically determinate PSC beams: Design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.

Transmission of prestress in pretensioned members; Anchorage zone stresses for post- tensioned members - Analysis and design of prestressed concrete pipes, columns with moments.

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.

Composite construction with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack width calculations.

REFERENCES:

1. Lin T.Y., Design of Prestressed Concrete Structures, Asia Publishing House, 1955.
2. Krishnaraju N., Prestressed Concrete, Tata McGraw Hill, New Delhi, 1981.
3. Guyan Y., Limited State Design of Prestressed Concrete, Applied Science Publishers, 1972.

4. IS: 1343- Code of Practice for Prestressed Concrete
5. IRC: 112

COURSE OUTCOMES:

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

1. Find out losses in the prestressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.
2. Analyse and design the prestressed concrete beams.
3. Analyse and design of prestressed concrete pipes and columns
4. Analyse and design the deck slab and beam/girders.
5. Analyse and design the composite prestressed concrete members.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2			√	√						√		
CO3		√	√			√						
CO4			√						√			
CO5		√	√	√				√				√

CZSEPEXX	**ANALYTICAL AND FINITE ELEMENT ANALYSIS OF LAMINATED COMPOSITE PLATES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To enable the students analyse composite plates using FEM.
- To train the students for developing computer programs towards the analysis of composite.

Introduction: Displacement Field Approximations for Classical Laminated Plate Theory (CLPT)and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending Of Rectangular Laminated Plates using CLPT.

Governing Equations Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT - Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix. **Formation of Load Vector**, Numerical Integration, Post Computation of Stresses.

Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT.

Finite Element Model, C0Element Formulation, Post Computation of Stresses - Analysis of Rectangular Composite Plates using Analytical Methods.

REFERENCES:

1. Reddy J. N., Mechanics of Laminated Composites Plates and Shells, CRC Press.

COURSE OUTCOMES:

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

1. Analyse the rectangular composite plates using the analytical methods.
2. Determine the analytical solutions for bending of laminated plates using FSTP.
3. Analyse the composite plates using advanced finite element method.
4. Gain the knowledge about the laminated composite plates.
5. Develop the computer programs for the analysis of composite plates.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2		√	√	√						√		
CO3		√				√						
CO4			√									
CO5		√		√				√				√

CZSEPEXX	**FRACTURE MECHANICS OF CONCRETE STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To enable the students identify cracking of concrete members based on fracture mechanics.
- To enable the students apply FM model to HSC and FRC structures.

Introduction: Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture and Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.

Stress at Crack Tip: Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin's Plastic Zone Correction,

R curves, Compliance, J Integral, Concept of CTOD and CMD.

Material Models: General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics, Applications to High Strength Concrete.

Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling.

REFERENCES:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
2. Broek David, Elementary Engineering Fracture Mechanics, 3rd Rev. Ed. Springer, 1982.

3. Elfgreen L., Fracture Mechanics of Concrete Structures – Theory and Applications, RILEM Report, Chapman and Hall, 1989.
4. Victor, Li C., Bazant Z. P., Fracture Mechanics – Applications to Concrete, ACI SP 118, ACI Detroit, 1989.

COURSE OUTCOMES:

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

1. Identify and classify cracking of concrete structures based on fracture mechanics.
2. Implement stress intensity factor for notched members
3. Apply fracture mechanics models to high strength concrete and FRC structures.
4. Compute J-integral for various sections understanding the concepts of LEFM.
5. Gain the knowledge about the fracture mechanics of concrete structures.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					
CO2		√		√						√		
CO3		√				√						
CO4	√											
CO5		√		√				√				

CZSEPEXX	DESIGN OF PLATES AND SHELLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To equip the students with analysis and design procedures for folded plate structures.
- To equip the students with analysis and design procedures for folded shell structures

Prismatic folded Plate Systems – Types - Assumptions – Boundary condition- Kirchoffs boundary condition.

Differential equation for bending of plates - Cylindrical bending of UDL of Rectangular plate - simply supported – built –in-edges – small deflection theory of laterally loaded - Analysis and Design of Cylindrical plates.

Classification of shells – membrane action –stress shell element and stress resultants –load transfer mechanism - Approximate Solutions.

Differential equation for bending of shells- Cylindrical bending of UDL of circular shell- simply supported – built –in-edges – small deflection theory of laterally loaded.

Analysis and Design of Cylindrical plates - Analysis and Design of Cylindrical shells.

REFERENCES:

1. Woinowsky-Krieger S., Theory of Plates and Shells, Timoshenko and Tata McGraw Hill Edition, 2010.
2. Ramaswamy G. S., Design and Construction of Concrete Shell Roofs, 1st Edition, 2005.
3. Varghese P. C., Design of Reinforced Concrete Shells & Folded Plate, 1st Edition, PHI.
4. Jawad Maan H., Design of Plate and Shell Structures, Springer Science.

COURSE OUTCOMES:

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

1. Analyse and design the folded plate systems.
2. Develop the shell equation for folded plates
3. Develop the approximate solutions for folded plates.
4. Analyse and design the cylindrical shells.
5. Analyse and design the double cylindrical shells.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√		√		√					
CO2			√	√						√		
CO3		√	√			√						
CO4			√									
CO5		√		√				√				

OPEN ELECTIVES

CZSEOEXX	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Business analytics:

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, Competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Trendiness and Regression Analysis:

Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Organization Structures of Business analytics:

Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Forecasting Techniques:

Qualitative and Judgmental Forecasting, Statiscal Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Over booking Model, Cash Budget Model.

Decision Analysis:

Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making.

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

REFERENCES:

1. Marc J. Schniederjans, Dara G. Schniederjan. S, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications Pearson FT Press.

2. James Evans, Business Analytics, persons Education.

COURSE OUTCOMES:

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

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modelling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.
5. To become familiar with processes needed to develop, report and analyses business data.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√				√	
CO2				√						√		
CO3		√				√					√	
CO4											√	
CO5		√		√				√				

CZSEOEXX	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students understand the importance of maintenance.
- To make the students understand the importance of safety.

Industrial safety:

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering:

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Wear and Corrosion and their prevention:

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii.

Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Fault tracing:

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

Periodic and preventive maintenance:

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

REFERENCES:

1. Higgins & Morrow, Maintenance Engineering Handbook, Da Information Services.
2. H. P. Garg, Maintenance Engineering, S. Chand and Company.
3. Audels, Pump-hydraulic Compressors, Mc grew Hill Publication.
4. Winterkorn, Hans, Foundation Engineering Handbook, Chapman & Hall London.

COURSE OUTCOMES:

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

1. Apply safety practices.
2. Inspect maintenance operations.
3. Trace faults in equipments.
4. Do event tree and fault tree analyse
5. Understand the concept and importance of repair recycle.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√					
CO2				√						√	√	
CO3		√				√					√	
CO4												
CO5		√		√				√			√	

CZSEOEXX	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To enable the students apply the concept of non- linear programming.
- To train the students for carrying out sensitivity analysis.

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

REFERENCES:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Liebermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

COURSE OUTCOMES:

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

1. Apply the dynamic programming to solve problems of discreet and continuous variables.
2. Apply the concept of non-linear programming
3. Carry out sensitivity analysis
4. Model the real world problem and simulate it.
5. Understand the concept and importance of scheduling and sequencing.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√		√		√		√					
CO2				√						√		
CO3		√				√						
CO4			√									
CO5		√		√				√				

CZSEOEXX	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the strategic cost management processes.
- To familiarise the students with various quantitative techniques for cost managements.

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making**;** relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project:

Meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non technical activities. Detailed Engineering activities. Pre project execution main clearances and documents

Project team:

Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing:

Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Budgetary Control:

Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

REFERENCES:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

COURSE OUTCOMES:

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

1. Understand cost accounting knowledge, such as terminology and fundamental principles and methods.
2. Plan project execution.

3. Plan project cost control.
4. Apply TQM practices.
5. Apply course material to new situations.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2				√						√		
CO3		√				√						
CO4			√									
CO5		√		√				√				

CZSEOEXX	**COMPOSITE MATERIALS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To familiarise the students with the constituents of composite materials.
- To train the students in designing with composite materials.

INTRODUCTION:

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS:

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

Manufacturing of Metal Matrix Composites:

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

Manufacturing of Polymer Matrix Composites:

Preparation of Moulding compounds and prepress – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

Strength:

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro thermal failure. Laminate first play failure-insight strength; Laminate

strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

REFERENCES:

1. Cahn R.W. , Material Science and Technology – Vol 13 – Composites,– VCH, West Germany.
2. WD Callister, Jr., Adapted R. Balasubramaniam, Materials Science and Engineering, An introduction, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Chawla K.K., Composite Materials.
5. Composite Materials Science and Applications – Deborah D.L. Chung.
6. Danial Gay, Suong V. Hoa, and StephenW.Tasi , Composite Materials Design and Applications.

COURSE OUTCOMES:

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

1. Understand mechanical behavior of composites.
2. Familiar with manufacturing of polymer matrix composites.
3. Do the design with composites.
4. Know about the manufacturing of metal matrix composites.
5. Determine stresses and strains relation in composite materials.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2		√	√	√						√		
CO3		√				√						
CO4			√				√					
CO5		√		√				√				

CZSEOE32	**WASTE TO ENERGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To make understand the recycling and reuse of waste.
- To familiarise the students with biomass technology.

Introduction to Energy from Waste:

Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis:

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Biomass Gasification:

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Biomass Combustion:

Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Biogas:

Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion -biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion -Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -Urban waste to energy conversion - Biomass energy programme in India.

REFERENCES:

1. Desai, Ashok V., Non-Conventional Energy, Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. and Mahdi, S. S., Biogas Technology - A Practical Hand Book, Vol. I &II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Challal, D. S., Food, Feed and Fuel from Biomass, IBH Publishing Co. Pvt. Ltd., 1991.
4. C. Y. WereKo-Brobby and E. B. Hagan, Biomass Conversion and Technology, John Wiley &Sons, 1996.

COURSE OUTCOMES:

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

1. Understand the concept of harnessing energy from waste.
2. Know the design, construction and operation of biomass gasifiers.
3. Come know about bio diesel, its production and applications.
4. Gain knowledge about Biomass Combustion.
5. Gain knowledge about Biogas.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√					
CO2			√	√						√		
CO3		√				√						
CO4	√		√									
CO5		√		√				√				

AUDIT COURSES

CZSEACXX	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

REFERENCES:

1. Goldbort. R., Writing for Science, Yale University Press (available on Google Books), 2006.
2. Day. R., How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
3. Highman. N., Handbook of Writing for the Mathematical Sciences, SIAM, 1998.
4. Highman'sbook , Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

COURSE OUTCOMES:

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

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section.
3. Understand the skills needed when writing a Title.
4. Understand the skills when writing the discussion
5. Ensure the good quality of paper at very first-time submission.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√		√	√				
CO2										√		
CO3						√		√				
CO4					√					√		
CO5						√		√				√

CZSEACXX	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and Humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work.

Repercussions of Disasters And Hazards:

Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas In India:

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Disaster Preparedness and Management:

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment:

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation In Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

COURSE OUTCOMES:

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

1. Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Understand the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Understand the strengths of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.
5. Understand the weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1					√		√					√
CO2	√									√		
CO3						√						√
CO4					√					√		
CO5						√						√

CZSEACXX	**SANSKRIT FOR TECHNICAL KNOWLEDGE**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

COURSE OBJECTIVES:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- Learning of Sanskrit to improve brain functioning.
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Alphabets in Sanskrit - Past/Present/Future Tense - Simple Sentences
Order - Introduction of roots - Technical information about Sanskrit Literature
Technical concepts of Engineering-Electrical, Mechanical - Architecture, Mathematics

REFERENCES:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

2. "Teach Yourself Sanskrit" PrathamaDeeksha-Vempati Kutumb shastri, Rashtriya SanskritSansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

COURSE OUTCOMES

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

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students
4. Understand the technical information about Sanskrit Literature
5. Understand the Technical concepts of other language.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√	√				√
CO2										√		
CO3						√		√				√
CO4					√					√		
CO5						√		√				√

CZSEACXX	**VALUE EDUCATION**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

COURSE OBJECTIVES:

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Values and self-development –Social values and individual attitudes - Work ethics, Indian vision of humanism - Moral and non- moral valuation - Standards and principles - Value judgments.
Importance of cultivation of values - Sense of duty. Devotion- Self-reliance - Confidence, Concentration – Truthfulness – Cleanliness Honesty, Humanity - Power of faith, National Unity – Patriotism - Love for nature - Discipline
Personality and Behavior Development - Soul and Scientific attitude - Positive Thinking. Integrity and discipline -Punctuality, Love and Kindness - Avoid fault Thinking - Free from anger, Dignity of labour - Universal brotherhood and religious tolerance - True friendship - Happiness Vs suffering, love for truth - Aware of self-destructive habits - Association and Cooperation - Doing best for saving nature.

Character and Competence –Holy books vs Blind faith - Self-management and Good health - Science of reincarnation - Equality, Nonviolence ,Humility, Role of Women - All religions and same message - Mind your Mind, Self-control - Honesty, Studying effectively.

REFERENCES:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

COURSE OUTCOMES:

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

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality
4. Understand the self-destructive habits
5. Know about the self-management and good health

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1					√		√	√				
CO2										√		
CO3						√		√				
CO4					√					√		
CO5						√		√				√

CZSEACXX	**CONSTITUTION OF INDIA**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

COURSE OBJECTIVES:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

History of Making of the Indian Constitution: History - Drafting Committee,(Composition& Working) - **Philosophy of the Indian Constitution:** Preamble - Salient Features

Contours of Constitutional Rights & Duties: Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational

Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.

Organs of Governance: Parliament – Composition - Qualifications and Disqualifications - Powers and Functions – Executive – President – Governor - Council of Ministers – Judiciary - Appointment and Transfer of Judges, Qualifications - Powers and Functions

Local Administration: District's Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO ZilaPachayat: Position and role - Block level: Organizational Hierarchy (Different departments) - Village level: Role of Elected and Appointed officials - Importance of grass root democracy

Election Commission: Election Commission: Role and Functioning - Chief Election Commissioner and Election Commissioners - State Election Commission: Role and Functioning - Institute and Bodies for the welfare of SC/ST/OBC and women

REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

COURSE OUTCOMES:

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

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.
5. Understand the role of election commission.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1					√		√	√				
CO2										√		√
CO3						√		√				
CO4					√					√		
CO5						√		√				√

CZSEACXX	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development. Syllabus Units Content Hours.

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices - Methodology for the in depth stage: quality assessment of included studies- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?- Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow-up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

Research gaps and future directions - Research design - Contexts - Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE OUTCOMES:

At the end of the course, Students will be able to understand:

1. Pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
2. Evidence on the effectiveness of these pedagogical practices.
3. Teacher education (curriculum and practicum) and the school curriculum and guidance materials that best support effective pedagogy.

4. The barriers to learning.
5. The research gaps and future directions.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√	√				
CO2										√		
CO3						√		√				
CO4					√					√		√
CO5						√		√				

CZSEACXX	**STRESS MANAGEMENT BY YOGA**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

COURSE OBJECTIVES:

- To achieve overall health of body and mind
- To overcome stress

Definitions of Eight parts of yog. (Ashtanga)
Yam and Niyam.
Do`s and Don't's in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan
Asan and Pranayam
Various yoga poses and their benefits for mind & body
Regularization of breathing techniques and its effects-Types of pranayam

REFERENCES:

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami YogabhyasiMandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

COURSE OUTCOMES:

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

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency
3. Understand the various Yoga poses.
4. Know about the regulation of breathings.
5. Know about the types of pranayama.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			
CO2	√									√		
CO3						√		√			√	√
CO4					√							
CO5						√		√			√	√

CZSEACXX	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination

Neetisatakam-Holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses-29,31,32 (pride & heroism) - Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses-71,73,75,78 (do's)

Approach to day to day work and duties –ShrimadBhagwadGeeta: Chapter 2-Verses 41, 47,48, - Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35 - Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge –ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 - Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, - Chapter 4-Verses 18, 38,39 - Chapter18 – Verses 37,38,63

REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE OUTCOMES:

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

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity.
3. Study of Neetishatakam will help in developing versatile personality of students.
4. Understand the ability to do day to day duty and work.
5. Study of Neetishatakam will help in developing rise himself in society.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)												
Course Outcomes (Cos)	**Programme Outcomes (Pos)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√				√		√	√				√
CO2										√		
CO3								√				√
CO4								√				√
CO5								√				√