ITEM NO.	APPENDIX

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

B.E., CIVIL AND STRUCTURAL ENGINEERING

REVISED REGULATIONS & SYLLABI

(Students Admitted From the Academic Year 2018-2019)

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 Provide quality education and knowledge base to the students in structural engineering.

M2 Prepare the students as nationally competitive and trend setters for the future generation in the realm of technical education.

M3 Assimilate the available theories, explore new frontiers, to propound new theories which will result in improving the quality of the life of the student community.

M4 Develop personality of the students in a healthy way and to provide opportunity to acquire knowledge in state-of-the-art research.

M5 Provide service to the university, engineering profession, and the public through consultancy services.

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 domain, feeding the needs of global expectations with professional competence.
PEO2	To explore the students in the field of Civil and Structural Engineering areas both in theory and practice and tuning the academic programmes periodically to make the students fit for professional jobs, research assignment or self-employment.
PEO3	To demonstrate their ability to deal effectively with ethical and professional issues, taking into account the broader societal implications.
PEO4	To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or a path to pursue higher studies.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	**Engineering Knowledge** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the 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 effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11	**Project Management and Finance** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-Long Learning** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1	Apply the knowledge of mathematics, science and fundamentals of engineering in the engineering problems to provide suitable, viable and economic solutions.
PSO2	Students can identify the problem, analyse and design according to the needs of the society and to come up with the environmental friendly sustainable solutions even for the complex problems.
PSO3	Apply modern tools and management techniques for the complex engineering problems, design of new experiments based on the researches, interpretation and analysis of data to make valid conclusions.
PSO4	Apply the principle of ethics in approaching different projects and problems, communicate with the concerns effectively, proper reports and documentations.

Mapping PO with PEO												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEO1	3	1	2	1	1	2	1	2	1	1	1	1
PEO2	3	2	1	1	2	1	1	1	1	1	1	1
PEO3	1	1	1	1	1	3	2	3	2	2	3	1
PEO4	1	2	2	3	3	1	1	1	1	3	1	2

COURSES OF STUDY AND SCHEME OF EXAMINATIONS (REGULATION -2019)

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETBS101	**BS-I**	Physics	3	1	0	25	75	100	4
ETBS102	**BS-I**	Mathematics –I	3	1	0	25	75	100	4
ETES103	**ES-I**	Basic Electrical Engineering	3	1	0	25	75	100	4
ETBP104	**BSP-I**	Physics Laboratory	0	0	3	40	60	100	1.5
ETSP105	**ESP-I**	Electrical Engineering Laboratory	0	0	2	40	60	100	1
ETSP106	**ESP-II**	Engineering Workshop/ Manufacturing Practices	1	0	4	40	60	100	3
									17.5

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETHS201	**HS-I**	English	2	0	0	25	75	100	2
ETBS202	**BS-III**	Chemistry	3	1	0	25	75	100	4
ETES203	**ES-II**	Programming for Problem Solving	3	0	0	25	75	100	3
ETBS204	**BS-IV**	Mathematics – II	3	1	0	25	75	100	4
ETHP205	**HSP-I**	Communication Skills and Language Laboratory	0	0	2	40	60	100	1
ETBP206	**BSP-II**	Chemistry Laboratory	0	0	3	40	60	100	1.5
ETSP207	**ESP-III**	Computer Programming Lab	0	0	4	40	60	100	2
ETSP208	**ESP-IV**	Engineering Graphics & Drafting	1	0	4	40	60	100	3
						Total Credits			**20.5**
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming III Semester.									

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETBS301	**BS-V**	Engineering Mathematics - III	3	1	-	25	75	100	4
ETES302	**ES-III**	Environmental Studies	3	-	-	25	75	100	3
ETES303	**ES-IV**	Engineering Mechanics	3	-	-	25	75	100	3
CEES304	**ES-V**	Construction Engineering	2			25	75	100	2
CEPC305	**PC-I**	Introduction to Fluid Mechanics	3	1	-	25	75	100	4
CZPC306	**PC-II**	Concrete Technology	3	-		25	75	100	3
CZSP307	**ESP-V**	Computer Practical-I (Building Drawings)	-	-	3	40	60	100	1.5
CECP308	**PCP-I**	Fluid Mechanics Laboratory	-	-	3	40	60	100	1.5
CZCP309	**PCP-II**	Concrete and Construction Laboratory	-	-	3	40	60	100	1.5
ETIT310	**IT-I**	Internship Inter/ Intra Institutional Activities*	***Four*** *weeks during the summer vacation at the end of* ***II Semester***				100	100	**4.0**
For the **Lateral entry students total credit for III Semester is **23.5** as they are exempted from internship during summer vacation of II semester.*						**Total Credits**			**27.5**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CZBS401	**BS-VI**	Probability Random Process and Numerical Methods	3	-	-	25	75	100	3
CZES402	**ES-VI**	Introduction to Solid Mechanics	2	-	-	25	75	100	2
CZPC403	**PC-III**	Engineering Economics, Estimation and Costing	3	-	-	25	75	100	3
CEPC404	**PC-IV**	Applied Hydraulics Engineering	3	-	-	25	75	100	3
CZPC405	**PC-V**	Structural Concrete Design-I	3	-	-	25	75	100	3
CZPC406	**PC-VI**	Surveying and Geomatics	3	-	-	25	75	100	3
CZCP407	**PCP-III**	Structural Materials Testing Laboratory	-	-	3	40	60	100	1.5

CECP408	**PCP-IV**	Hydraulics Engineering Laboratory	-	-	3	40	60	100	1.5
CZCP409	**PCP-V**	Surveying and Geomatics Laboratory	-	-	3	40	60	100	1.5
									21.5
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming V Semester.									

SEMESTER V									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CZPC501	**PC-VII**	Structural Mechanics-I	3	-	-	25	75	100	3
CZPC502	**PC-VIII**	Structural Steel Design-I	3	-	-	25	75	100	3
CZPC503	**PC-IX**	Soil Mechanics	3	-	-	25	75	100	3
CZPC504	**PC-X**	Structural Concrete Design-II	3			25	75	100	3
CZPE505	**PE-I**	Hydrology and Water Resource Engineering	3	-	-	25	75	100	3
CZPE506	**PE-II**	Engineering Geology	3	-		25	75	100	3
CZCP507	**PCP-VI**	Computer Practical-II	-	-	3	40	60	100	1.5
CZCP508	**PCP-VII**	Geotechnical Engineering Laboratory	-	-	3	40	60	100	1.5
CZCP509	**PCP-VIII**	Structural Reinforcement Detailing Laboratory	-	-	3	40	60	100	1.5
ETIT510	**IT-II**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	***Four*** *weeks during the summer vacation at the end of* ***IV Semester***				100	100	**4.0**
						Total Credits			**26.5**

SEMESTER VI									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CZPC601	**PC-XI**	Structural Mechanics-II	3	-	-	25	75	100	3
CZPC602	**PC-XII**	Disaster Preparedness and Planning	3	-	-	25	75	100	3
CZPE603	**PE-III**	Structural Steel Design-II	3	-	-	25	75	100	3
CZPE604	**PE-IV**	Structural Concrete Design-III	3	-	-	25	75	100	3
CZPE605	**PE-V**	Transportation Engineering	3	-	-	25	75	100	3

CZOE606	**OE-I**	**Foundation Engineering**	3	-	-	25	75	100	3
CZCP607	**PCP-IX**	Advanced Material Testing Laboratory	-	-	3	40	60	100	1.5
CZCP608	**PCP-X**	Computer Practical-III	-	-	3	40	60	100	1.5
									21.0
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII Semester.									

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETHS701	**HS-II**	Professional Practice, Law and Ethics	2	-	-	25	75	100	2
CZPC702	**PC-XIII**	Instrumentation and Sensor Technologies for Civil Engineering Applications	3	-	-	25	75	100	3
CZPE703	**PE-VI**	Prestressed Concrete	3	-	-	25	75	100	3
CZPE704	**PE-VII**	Environmental Engineering	3	-	-	25	75	100	3
CZOE705	**OE-II**	**Finite Element Method**	3	-	-	25	75	100	3
CZCP706	**PCP-XI**	Instrumentation and Sensor Technologies for Civil Engineering Applications & Earthquake Engineering Laboratory	-	-	3	40	60	100	1.5
ETIT707	**IT-III**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	***Four*** *weeks during the summer vacation at the end of* ***VI Semester***				100	100	**4.0**
						Total Credits			**19.5**

SEMESTER VIII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CZOE801	**OE-III**	**Earthquake Engineering**	3	-	-	25	75	100	3
CZOE802	**OE-IV**	**Repair and Rehabilitation of**	3	-	-	25	75	100	3

		Concrete Structures							
CZPV803	**PV-I**	**Project Work and Viva-Voce**	-	**PR** 10	**S** 2	40	60	100	6
									12

L	No. of Lecture Hours	**TR**	No. of Hours for Discussion on Industrial Training
T	No. of Tutorial Hours	**S**	No. of Seminar Hours on Industrial Training / Project
P	No. of Practical Hours	**PR**	No. of Hours for Discussion on Project work
CA	Continuous Assessment Marks	**FE**	Final Examination Marks
Credits	Credit points allotted to that course	**Total**	Total Marks

Sl. No.	Course Code	PROFESSIONAL ELECTIVES
1	CZPE505	Hydrology and Water Resource Engineering
2	CZPE506	Engineering Geology
3	CZPE603	Structural Steel Design II
4	CZPE604	Structural Concrete Design III
5	CZPE605	Transportation Engineering
6	CZPE703	Prestressed Concrete
7	CZPE704	Environmental Engineering
8	CZPESCN	Structural Concrete Design IV
9	CZPESCN	Advances in Concrete Technology
10	CZPESCN	Design of Load Bearing Masonry
11	CZPESCN	Scaffolding and Form Work Design in Construction
12	CZPESCN	Tall Buildings

Sl. No.	Course Code	OPEN ELECTIVES
1	CZOE606	Foundation Engineering
2	CZOE705	Finite Element Method
3	CZOE801	Earthquake Engineering
4	CZOE802	Repair and Rehabilitation of Concrete Structures

Sl. No.	Course Code	HONOURS ELECTIVES	Credits
1	CZHESCN	Behaviour of Reinforced Concrete Structures	4
2	CZHESCN	Dynamics of Structures	4
3	CZHESCN	Bridge Engineering	3
4	CZHESCN	Composites for Construction	3
5	CZHESCN	Design of Plates and Shells	3
6	CZHESCN	Disaster Resistant Design of Structures	3

Sl. No.	Course Code	MINOR ENGINEERING ELECTIVES	Credits
1	CZMISCN	Construction Techniques and Management	3
2	CZMISCN	Services in High Rise Buildings	3
3	CZMISCN	Smart Materials and Smart Structures	3
4	CZMISCN	Ground Improvement Techniques	4
5	CZMISCN	Theory of Elasticity and Plasticity	4
6	CZMISCN	Urban and Rural Planning	3

SEMESTER III

ETBS301	ENGINEERING MATHEMATICS III	L	T	P	C
		3	1	-	3

COURSE OBJECTIVES

- To learn Partial Differential equations, Fourier Series and Boundary Value Problems.
- To learn the transforms such as Sine, Cosine, Fourier Transform and Z Transforms.
- To gain the knowledge of the method to find the solutions of different method.

UNIT I Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

UNIT II Fourier Series

Dirichle's conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval's identity.

UNIT III Boundary Value Problems

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT IV Fourier Transform

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's identity.

UNIT V Z Transform and Difference Equations

Z–Transform – Elementary properties – Inverse Z–Transform – Convolution theorem – Solution of difference equations using Z–Transform.

TEXT BOOKS

1. Kandasamy.P, Tilagavathy.K and Gunavathy.K, *Engineering Mathematics*, 6th Edition, (Vol-I & II), 2007, S.Chand & Co Ltd., New Delhi.
2. Venkataraman.M.K., *Engineering Mathematics*, 2003, The National Publishing Co., Chennai.

REFERENCES

1. Veerarajan.T, *Engineering Mathematics*, 3rd Edition, 2005, Tata McGraw Hill Publication Co. Ltd., New Delhi.
2. Singaravelu.A, *Engineering Mathematics*, 2004, Meenakshi Publications, Chennai.

3. C.L.Liu, *"Elements of Discrete Mathematics",* Second Edition, 2000, Tata McGraw-Hill.
4. J.L.Hein, "Discrete Structures, Logic, and Computability", 3rd Ed., 2010, Jones and Bartlett.
5. K.H.Rosen, "*Discrete Mathematics and its Applications",* sixth Edition, 2007, Tata McGraw-Hill.

COURSE OUTCOMES

At the end of the course the students will be able to acquire knowledge on

1. Be capable of mathematically formulating certain practical problems in terms of partial differential equation. Solve them and physically interpret the results.
2. Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical Fourier analysis that an engineer may have to make from discrete data.
3. Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve and interpret the results.
4. Have grasped the concept of expression of a function under certain conditions as a double integral leading to identification of transform pair, and specialization of Fourier transform pair, their properties, and the possible special cases with attention to their applications.
5. Have learnt the basics of z transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the z transform techniques bringing out the elegance of the procedure involved.

Mapping of COs with POs													**Mapping with PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	1	2								1	3	2	2	
CO2	3	3	1	2								1	3	2	2	
CO3	2	3	1	3								1	3	3	3	
CO4	2	3	1	3								1	3	3	3	
CO5	2	3	2	3								1	3	3	3	

ETES302	ENVIRONMENTAL STUDIES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To realize the importance of environment for engineering students.
- To understand the basis of ecosystems
- To make aware the students about global environmental problems and natural disasters.
- To give the ideas about advance technologies of engineering that will useful to protect environment.

UNIT I Introduction

Introduction - Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness - Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources- Equitable use of resources for sustainable lifestyles.

UNIT II Ecosystem

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III Diversity

Introduction – Definition: genetic, species and ecosystem diversity - Bio geographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT IV Pollution

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust - Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation.

UNIT V Social Welfare

Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health - Case Studies.

FIELD WORK

Visit to a local area to document environmental assets river / forest / grass land / hill / mountains. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural – Study of commom plants, insects, birds – Study of simple ecosystems – pond, river, hill slopes, etc. **(Field work equal to 5 lecture hours)**

TEXT BOOKS

1. Agarwal, K.C., *Environmental Biology*, 2001Nidi Publishers Ltd., Bikaner.
2. Bharucha Erach, *The Biodiversity of India*, Mapin Publishing Pvt. Ltd., Ahmedabad.

REFERENCES

1. Brunner R.C., 1989, *Hazardous Waste Incineration*, McGraw Hill Inc. 480p
2. Clark R.S., *Marine Pollution*, Clanderson Press Oxford
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, *Environmental Encyclopaedia*, Jaico Publ. House, Mumbai, 1196p
4. De A.K., *Environmental Chemistry*, Wiley Eastern Ltd.
5. *Down to Earth*, Centre for Science and Environment
6. Gleick, H.P. 1993. *Water in crisis*, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
7. Hawkins R.E., *Encyclopaedia of Indian Natural History*, Bombay Natural History Society, Bombay
8. Heywood, V.H & Waston, R.T. 1995. *Global Biodiversity Assessment*. Cambridge Univ. Press 1140p.

9. Jadhav, H & Bhosale, V.M. 1995. *Environmental Protection and Laws*. Himalaya Pub. House, Delhi 284 p.
10. Mckinney, M.L. & School, R.M. 1996. *Environmental Science systems & Solutions*, Web enhanced edition. 639p.
11. Miller T.G. Jr. *Environmental Science*, Wadsworth Publishing Co.
12. Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders Co. USA, 574p
13. Rao M N. & Datta, A.K. 1987. *Waste Water treatment*. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
14. Sharma B.K., 2001. *Environmental Chemistry*. Geol Publ. House, Meerut
15. Townsend C., Harper J, and Michael Begon, *Essentials of Ecology*, Blackwell Science
16. Trivedi R.K., *Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards*, Vol I and II, Enviro Media (R)
17. Trivedi R. K. and P.K. Goel, *Introduction to air pollution*, Techno-Science Publication
18. Wanger K.D., 1998 *Environmental Management*. W.B. Saunders Co. Philadelphia, USA

COURSE OUTCOMES

At the end Students can able to

1. Understand the importance of environment.
2. Analyse the importance of environment in engineering.
3. Apply their own ideas and demonstrate advanced technologies that will be useful to protect environment.
4. Employ awareness among the society about environmental problems and natural disasters.
5. Practice according to the present and future environmental issues.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2						3				2	2	2	1		1
CO2	2	3		2			3				2	2	3	2	2	1
CO3	2		3	2			3				2	2	2	2	2	1
CO4	2					3	3				2	2	2	2		1
CO5	2						3				2	2	2	1		1

ETES303	ENGINEERING MECHANICS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To provide an introductory treatment of *Engineering Mechanics* with a view to prepare a good foundation for taking up advanced courses.
- To provide knowledge of statics with emphasis on force equilibrium, equilibrium equations, and free body diagrams.
- To understand the basics of kinds of stress, moments and deformation in rigid bodies under different loading conditions and inertia problems.
- To determine the behaviour of wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

UNIT I Introduction to Engineering Mechanics

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

Friction - Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

UNIT II Basic Structural Analysis

Equilibrium in three dimensions-Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.

Centroid and Centre of Gravity - Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT III Virtual Work and Energy Method

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

UNIT IV Review of Particle Dynamics

Rectilinear motion - Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2^{nd} law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Introduction to Kinetics of Rigid Bodies - Basic terms, general principles In dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work

energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

UNIT V Mechanical Vibrations

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

Tutorials

To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack.

TEXT BOOKS

1. Irving H. Shames., *"Engineering Mechanics",* Fourth Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R. Johnston, "*Vector Mechanics for Engineers,* Vol I - Statics, Vol II, – Dynamics, Nineth Ed, Tata McGraw Hill., 2011.

REFERENCES

1. R.C. Hibbler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.
2. Andy Ruina and Rudra Pratap, "Introduction to Statics and Dynamics", Oxford University Press, 2011.
3. Shanes and Rao., "Engineering Mechanics", Pearson Education, 2006.
4. Hibler and Gupta "Engineering Mechanics (Statics, Dynamics)", Pearson Education, 2010.
5. Reddy Vijaykumar K. and K. Suresh Kumar., "Singer's Engineering Mechanics", 2010.
6. Bansal R.K., "A Text Book of Engineering Mechanics", Laxmi Publications, 2010.
7. Khurmi R.S., "Engineering Mechanics", S. Chand & Co., 2010.
8. Tayal A.K., "Engineering Mechanics, Umesh Publications, 2010.

COURSE OUTCOMES

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

1. Use scalar and vector analytical techniques for analysing forces in structures.
2. Apply basic knowledge of maths and physics to solve real world problem.
3. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
4. Determine resultants and apply conditions of static equilibrium to plane force stystems.
5. Calculate the motion characteristics of a body subjected to a force system and mechanical vibrations.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2		2	1						3	3	2	2	
CO2	3	2	3	3	2	1						3	3	3	3	
CO3	3	2		3	2	1						3	3	2	3	
CO4	3	2		3	2	1						3	3	2	3	
CO5	3	2		3	2	1						3	3	2	3	

CEES304	CONSTRUCTION ENGINEERING	L	T	P	C
		3	-	-	2

COURSE OBJECTIVES

- To expose the students to construction practice through an understanding of different types of construction materials and their properties.
- To understand the techniques of construction, different finishing works and remedial practices for distressed structures.
- To impart knowledge of modern construction materials and equipments.

UNIT I Properties of Construction Materials

Stones (Dressed) – Bricks – Cement – Steel – Sand and Quarry Dust – Timber – FRP (Fibre Reinforced Polymer) – Composite materials – Physical and Chemical Properties – Manufacturing Process – Classification – Test on materials – IS Standards and Specifications for use in construction as per SP 21: 1983

UNIT II Substructure

Introduction – Types of Soils – Classification of soils as per IS standards – Cohesion and Adhesion of soil – Bearing Capacity of soil – Methods of Assessing Bearing Capacity of Soils – Types of Foundations – Shallow Foundations – Deep Foundations – Special type of Foundations for Shore and Offshore Structures – Foundations with Rock Anchors.

UNIT III Superstructure

Introduction – Masonry – Types of Masonry – Reinforced Cement Concrete (RCC) works like Footings, Columns, Plinth Beams, Lintels, Sill slab, Sunshades, Roof Beams and Roof Slabs – Fabrication of Steel, Bar Bending as per IS Standards (SP 34: 1987), Cover Blocks, Placing of Bars in Form Work – Types of Roofing Systems – Types of Stairs – Types of Doors, Windows and Ventilators – Methods of Termite Proofing – Methods of Damp proofing.

UNIT IV Finishing of Superstructure

Types of Floor finishes - Mud Flooring, Cement flooring, Ceramic Tile Flooring, Marble and Granite Flooring, Wooden Flooring, Flooring with Puffed Panels – Plastering (Interior and Exterior) – Pointing for Walls and Floors using Grouts – White Washing, Colour Washing with different Colour Shades available in the Markets – Painting – Types of Painting for Interior and Exterior application. Form Work (Shuttering or Scaffolding) - Types of Form Work – Use of Shoring and Underpinning.

UNIT V Special materials and Repairs

Introduction – Glass – Ceramics – PVC – UPVC – Refractory – Aluminium – Lightweight Concrete Blocks – Poly Carbonate Sheets – Insulated Puffed Sheets – Sealant Joints – Uses in construction. Cracks in Buildings – Causes – Methods of Repairs– Equipments used for Repair works.

TEXT BOOKS

1. Punmia.B.C, *Construction Engineering*, Laxmi Publishers Private Limited, New Delhi, 1993.
2. Arora S.P. & Bindra S.P, *A Text Book of Building Construction*, Dhanpat Rai & Sons, New Delhi, 2010.

REFERENCES

1. Rangwala.S.C, *Building Construction*, Charotar Publishing House Pvt. Ltd,Gujarat, 2009.
2. Sharma and Kaul, *Building Construction*, S.Chand & Company, New Delhi, 1987.
3. Rajput.R.K, *Engineering Materials*, S.Chand & Company, New Delhi. 2008.

STANDARDS

1. SP 21: 1983 Handbook on Summaries of Indian Standards for Building Materials, Bureau of Indian Standards, New Delhi.
2. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able to

1. Compare the properties of most common and advanced building materials.
2. Understand the typical and potential applications of these materials.
3. Acquire knowledge of testing of construction materials and their strength requirements.
4. Recognize the functions of different building components.
5. Understand the usage of modern building materials and construction equipments and apply techniques to repair buildings.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3			2		2	2	2	1			1	2	3	2	2
CO2	3			2		2	2	2	1		1	1	2	3	2	3
CO3	3	1		2	3	2	2		1				3	3	3	2
CO4	3		1	2		2	1		1		1	2	2	2	2	2
CO5	3		1	2		2	1		1		1	2	2	2	2	2

CEPC305	INTRODUCTION TO FLUID MECHANICS	L	T	P	C
		3	1	-	4

COURSE OBJECTIVES

- To introduce the concepts of fluids mechanics thorough understanding of the properties of the fluids, behavior of fluids under static conditions.
- To learn dynamics of fluids through control volume approach this gives an integrated understanding of the transport of mass, momentum and energy.
- To expose to boundary layer theory and a training to analyze engineering problems involving fluid.
- To understand the applications of the conservation laws to (a) flow measurements and (b) flow through pipes (both laminar and turbulent).

UNIT I Properties of Fluids

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT II Fluid Pressure

Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT III Fluid Flow

Fluid Kinematics-Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates.

UNIT IV Fluid Dynamics

Fluid Dynamics- Surface and body forces; Equations of motion – Euler's equation; Bernoulli's equation-derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced.

UNIT V Dimensional Analysis

Dimensional Analysis and Dynamic Similitude – Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

TEXT BOOKS

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, "*Fluid Mechanics and Machinery",* Oxford University Press, 2010
2. P M Modi and S M Seth, "*Hydraulics and Fluid Mechanics",* Standard Book House.

REFERENCES

1. K. Subramanya, "Theory and Applications of Fluid Mechanics", Tata McGraw Hill.
2. R.L. Daugherty, J.B. Franzini and E.J.Finnemore, "Fluid Mechanics with Engineering Applications", International Student Edition, Mc Graw Hill.

COURSE OUTCOMES

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

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2									3	3	1	
CO2	3					1							3	1		
CO3	3	3											3	2		
CO4	3	3	2	2									3	3	1	
CO5	3	3	2	3									3	3	2	

CZPC306	CONCRETE TECHNOLOGY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To develop systematic knowledge about the nature and basic properties of the ingredients of concrete.
- To familiarises the testing procedures for properties of fresh and hardened concrete.
- To introduce fundamentals and principles of mix design.

UNIT I Cement

Portland cement– Definition –History–Composition–Hydration of Portland cement – Stiffening and Hardening of cement paste–Specification as per IS 269-1989 Code– Types of Portland cement–Physical and Chemical Properties of cement – Testing of cement

UNIT II Aggregates

Aggregates– Natural and Mineral aggregates – Characteristics of aggregates and their significance–Testing of aggregates properties as per IS:2386 (I to VIII)- 1963–comparison of properties with IS:383-1970. Importance of aggregates properties in concrete –Water– Testing–Specifications.

UNIT III Concrete

Concrete ingredients – Manufacturing process –Storing - Batching – Mixing – Transporting – Placing – Finishing – Curing- Properties of fresh concrete – Workability measurements - Testing methods – Segregation- Bleeding - Slump loss – Concrete at early age – Setting time – Concrete admixture and its types.

UNIT IV Properties of Concrete

Hardened concrete- Mechanical Properties and their significance- Testing methods as per IS: 516-1959–Compressive strength of concrete and its influencing factors –Short term and long term properties - Drying shrinkage – Creep – Modulus of elasticity – Resistance to dimensional changes - Resistance to weather– Resistance to chemical attack - Durability of concrete. (Special concrete; types and specifications, Fibre reinforced and steel Fibre reinforced concrete, Polymer concrete, Use of admixtures; Deterioration of concrete and its prevention Repair and rehabilitation.

UNIT V Mix Design

Objectives of mix design –Concept of concrete mix proportioning- Methods of mix proportioning as per IS: 10262-2009 and ACI Committee 211.1.91 method – Fly ash based concrete mix design – Effect of replacement materials for binder and filler in mix design-sustainable concrete.

TEXT BOOKS

1. Mehta P.K., and Montero P.J.M., "*Concrete, Microstructure, Properties and Materials",*Indian Concrete Institute, Chennai, 1997.
2. Shetty M.S., "*Concrete Technology"*, S.Chand & Co., New Delhi, 2002.

REFERENCES

1) Neville A.M., *Properties of Concrete*, Pitman Publishing Limited, London, 2011.
2) Gambhir M.L., *Concrete Technology*, McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
3) Neville A.M., and Brooks J.J., *Concrete Technology*, Pearson Education, Indian reprint, Chennai, 2002.

STANDARDS

1. IS 269: 1989 Specification for Ordinary Portland cement, 33 grade (fourth revision), Bureau of Indian Standards, New Delhi.
2. IS 383: 1970, Specification for Coarse and Fine Aggregate from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi.
3. IS516: 1959,Method of Test for Strength of Concrete (with Amendment No.2), Bureau of Indian Standards, New Delhi.
4. IS 2386 (Part I to VIII):1963, Method of Test for Aggregate for Concrete, Bureau of Indian Standards, New Delhi
5. IS 4031(Part I to X): 1988, Method of Physical Tests for Hydraulic cement, Bureau of Indian Standards, New Delhi.
6. IS 10262: 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
7. IS 8112 (re-affirmed in 2000), Specification for 43 grade Ordinary Portland cement, Bureau of Indian Standards, New Delhi.
8. IS 12269-1987, Specification for 53 grade Ordinary Portland cement (with Amendment No.3) Bureau of Indian Standards, New Delhi.
9. SP 23:1982 Hand book on Concrete Mixes, Bureau of Indian Standards, New Delhi.
10. ACI Committee 211.1-91 Standard Practice for Selecting Proportions for Normal, Heavy weight and Mass Concrete, American Concrete Institute, Farmington Hill, Michigan, USA,2002

COURSE OUTCOMES

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

1. Compare the properties of most common and advanced building materials.
2. Test the construction materials to determine their properties and strength requirements.
3. Understand the typical and potential applications of these materials.
4. Analsye the properties of concrete and recommend it to the suitable purpose.
5. Calculate the mix ratio of concrete according to the requirements.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	3	1	1							3	3	2	1	
CO2	2	3	3	1	1							3	3	2	1	
CO3	2	3	3	2	1							3	3	3	2	
CO4	2	3	3	2	1							3	3	3	2	
CO5	2	3	3	2	1							3	3	3	2	

CZSP307	COMPUTER PRACTICAL I (BUILDING DRAWINGS)	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in developing skills in drawings and detailing of the Building components using AUTOCAD and also develop the skills of using MS office Excel for estimating and costing the Buildings.

LIST OF EXERCISES

Plate 1. Symbols used in Civil Engineering drawings.

Plate 2. Doors, Windows and Ventilators (wooden, glazed and aluminium)

Plate 3. Comprehensive Planning and Drawings of Residential building

Layout, plan, elevation & sectional elevation based on the NBC standards

a. Single Room RCC roof building
b. Double Room RCC roof building
c. Bungalow/duplex building with sloped tiled Roof
d. 2BHK types Residential building
e. Two storied Residential building

Plate 4. Preparation of Layout plan of different types of commercial building Projects.

a. School building,
b. Office building (Bank, Government office, IT park)
c. Hospital building, and
d. Shopping Mall

Plate 5. Draw the Residential building Layout, plan, elevation & sectional view with all specification and standards of municipal guidelines (Local Bylaws).

MS office – EXCEL

Exercise 1. Practicing of MS office Excel worksheet – file creation – formulas – chart preparation – pivot table

Exercise 2. Preparation of building Estimation of the practiced drawing

REFERENCES

1. Verma B.P, "*Civil Engineering Drawing and housing Planning"*, Khanna Publishers, New Delhi 1992.
2. Balagopal T.S. Prabhu., "*Building drawing and detailing"*, Spades Publishers, Calicut, 1987.
3. National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
4. Shah & Kale, "*Building Drawing"*, Tata McGraw Hill, New Delhi, 2002.
5. MSOffice Manual.

COURSE OUTCOMES

At the completion of the course students will be able

1. To identify the drawings of detailing and building plans.
2. Draw the building plans and sections using AUTOCAD.
3. To prepare the doors and windows details and other requirements.
4. To draw approval plans with complete requirements of the authorities.
5. To prepare the estimation of buildings in spreadsheets.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				2	1		1					2	1	1	1
CO2	3				2	1				2			2	1	1	1
CO3	2					1							1	1		
CO4	3					1	2	2		2			2	2		2
CO5	3				2	1		2		2	2	1	2	1	1	3

CECP308	FLUID MECHANICS LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To understand the concepts of flow of fluids under static and dynamic conditions
- To understand the discharge capacities through various notches and channels
- To have a knowledge on dimensional analysis of flow

LIST OF EXPERIMENTS

a. Measurement of viscosity
b. Study of Pressure Measuring Devices
c. Stability of Floating Body
d. Hydrostatics Force on Flat Surfaces/Curved Surfaces
e. Verification of Bernoulli's Theorem
f. Venturimeter
g. Orifice meter
h. Impacts of jets
i. Flow Visualisation -Ideal Flow
j. Length of establishment of flow
k. Velocity distribution in pipes
l. Laminar Flow
    1) Determination of Co-efficient of discharge of **Mouthpiece**
    2) Determination of Co-efficient of discharge of **Venturimeter**
        a. Determination of Co-efficient of Head loss due to **Sudden Change in Section**
    3) Determination of Co-efficient of Head loss due to **Friction in Pipes**
    4) Determination of Co-efficient of discharge of **Rectangular Notch**
    5) Determination of Co-efficient of **Impact of Jet on Vanes**
    6) Determination of **Metacentric Height** of a floating vessel

REFERENCES

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli., "*Fluid Mechanics and Machinery",* Oxford University Press, 2010.
2. P M Modi and S M Seth., "*Hydraulics and Fluid Mechanics",* Standard Book House
3. K. Subramanya., "*Theory and Applications of Fluid Mechanics",* Tata McGraw Hill
4. R.L. Daugherty, J.B. Franzini and E.J.Finnemore, "*Fluid Mechanics with Engineering Applications",* International Student Edition, Mc Graw Hill.

COURSE OUTCOMES

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

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Be able to apply the continuity, momentum and energy principles
5. Be able to apply dimensional analysis

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					2							2	2		
CO2	3					1							2	1		
CO3	3					1							2	1		
CO4	3					1							2	1		
CO5	3					1							2	1		

CZCP309	CONCRETE & CONSTRUCTION LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in standard testing procedures for different compositions of building materials and provides them an opportunity to design a concrete mix.

LIST OF EXPERIMENTS

1. Standard Tests on Cement as per IS Standards
2. Standard test on fine and coarse aggregates as per IS Standards
3. Workability tests on Fresh Concrete
4. Tests on Hardened Concrete, Bricks and Tiles as per IS Standards
5. Concrete Mix design as per IS 10262: 2009
6. Study on Reinforcement Detailing for different Structural Components as per SP34: 1987.

REFERENCES

1. Mehta P.K and Monter P.J.M., *Concrete, Microstructure, Properties and Materials*, Indian Concrete Institute, Chennai, 1997.
2. Shetty M.S., *Concrete Technology*, S. Chand & Co., New Delhi, 2002.
3. Neville A.M., *Properties of Concrete*, Pitman Publishing Limited, London, 2011.
4. Gambhir M.L**.,** *Concrete Technology*, Tata McGraw Hill Co., New Delhi,2004.
5. Neville A.M., and Brooks J.J**.,** *Concrete Technology*, Pearson Education, Indian Reprint, Chennai, 2002.

STANDARDS

1. IS 269: 1989 Specification for Ordinary Portland cement, 33 grade (fourth revision), Bureau of Indian Standards, New Delhi
2. IS 383: 1970, Specification for Coarse and Fine Aggregate from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi.
3. IS 516: 1959, Method of Test for Strength of Concrete (with Amendment No.2), Bureau of Indian Standards, New Delhi
4. IS 2386 (Part I to VIII) :1963, Method of Test for Aggregate for Concrete, Bureau of Indian Standards, New Delhi
5. IS 4031(Part I to X): 1988, Method of Physical Tests for Hydraulic cement, Bureau of Indian Standards, New Delhi
6. IS 8112-1989 (re-affirmed in 2000), Specification for 43 grade Ordinary Portland cement, Bureau of Indian Standards, New Delhi.
7. IS 10262: 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
8. IS 12269-1987, Specification for 53 grade Ordinary Portland cement (with Amendment No. 3) Bureau of Indian Standards, New Delhi.
9. SP 23:1982 Hand book on Concrete Mixes, Bureau of Indian Standards, New Delhi.
10. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

At the completion of the course students will be able

1. Identify the tests for determining concrete properties
2. To test the workability of a concrete for specific purpose depends on requirements.
3. To determine the strength of hardened concrete, bricks, tiles, coarse aggregates, etc.
4. Calculate the mix proportion for concrete
5. Identify the detailing of the structural reinforcements

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				1	2	1						2	1	1	
CO2	3		2										2	1		
CO3	3				2	1							2	1	1	
CO4	3		2				1						2	2		
CO5	3												2			

ETIT310	INDUSTRIAL TRAINING / RURAL INTERNSHIP / INNOVATION / ENTREPRENEURSHIP	L	TR	S	C
		-	1	2	2

COURSE OBJECTIVES

1. To encourage the students to study advanced engineering developments.
2. To Prepare and present technical reports.
3. To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATIONS

1. During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
2. In a session of 3 periods per week, 15 students are expected to present the seminar.
3. Each student is expected to present at least twice during the semester and the student is evaluated based on that.
4. At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
5. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
6. Evaluation is 100% Internal.

COURSE OUTCOMES

1. The students know the advanced engineering developments.
2. Able to Prepare and present technical reports.
3. Able to use various teaching aids such as over head projectors, power point presentation and demonstrative models.
4. Able to present infront of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1				1	3	3		1		3		2
CO2	3	3	3	3		2			3	3	2	1	1	2	2	3
CO3	3	3	3		2	1	2		3	3	1		3	3	2	2
CO4							3	3	3	2				1		2
CO5	3	2	1						3	3	1	1	1	2	3	3

SEMESTER IV

CEBS401	PROBABILITY RANDOM PROCESS AND NUMERICAL METHODS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- Be exposed to probability, random processes, and ststistical methods designed to contribute to the process of making scientific judgements in the face of uncertainty and variation.
- To develop the skills of the students in numerical mathematics – using method of finite difference interpolation, finding numerical solution of algebraic and transcendental equations, and finding numerical solution of ordinary and partial differential equations.

UNIT I Probability and Random Variables

Definition – Types of random variables – probability distribution functioon – probability density function – expectation and moments – moment generating functions – joint probability distribution – marginal probability distribution function – joint probability density function - marginal probability density function – conditional probability density function.

UNIT II Random Processes

Classification of random processes – Methods of description of a random process – Special classes of random processes – Average values of random process – Stationarity – Autocorrelation function and its properties – cross correlation function and its properties.

UNIT III Test of Significance

Hypothesis, testing – Large sampling tests – small sampling test based on t, F and chi-square distributions – interval estimates of mean, standard deviation and proportion.

UNIT IV Interpolation, Numerical Differentiation and Integration

Interpolation: Gregory Newton forward and backward interpolation formula; Stirling's central difference formula; Lagrange's interpolation formula for unequal interval.

Numerical differentiation: Using Newton's forward and backward interpolation formula.

Numerical integration: Trapezoidal rule, Simpson's one-third and three-eight rule.

UNIT V Solution of Algebraic and Transcendental and Ordinary Differential Equations

Solution of algebraic and transcendental equations: Bolzano's bisection method, Regula-falsi method, Newton-Raphson method.

Solution of simultaneous algebraic equation: Gauss elimination method, Crout's method, Gauss-Seidel iteration method.

Solution of ordinary differential equations: Taylor series method, Runge-Kutta fourth order method, Milne's – Predictor corrector method.

TEXT BOOKS

1. Kandasamy,P., Thilagavathy, K., and Gunavathy, K., Probability and Random Processes, S.Chand & Co. Ltd., New delhi.
2. Veerarajan, T., Probability Theory and Random Process, tata McGraw Hill Co., Ltd., New Delhi, 2005.

REFERENCES

1. Venkatraman, M.K., Numerical Method in Science and Engineering, national Publishing Co., Chennai – 2003
2. Lipschutz, S. and Schiller, J., Schaums' Outlines, Introduction to Probability and Statistics, McGraw Hill, New Delhi, 1998.
3. Kandasamy,P., Thilagavathy, K., and Gunavathy, K., Numerical Methods, S.Chand & Co. Ltd., New Delhi, 2004.

COURSE OUTCOMES

The students should be able to

1. Collect data on a problem and describe the data using graphical and descriptive measures; develop a probabilistic model for the problem; perform probability operations and evaluations;
2. Acquire skills in handling situations involving random variables and random processes Perform statistical analyses of the data and hypotheses testing
3. Perform correlation and regression analyses for fitting a curve or model to data and formulate algorithms to solve problems
4. To solve problems for engineers in using numerical methods.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3							1			3	2		1
CO2	3	3								1			3	1		1
CO3	3				2	1				1			2	1	1	1
CO4		3	2	2					1			1	2	3	1	

CZES402	INTRODUCTION TO SOLID MECHANICS	L	T	P	C
		2	-	-	2

COURSE OBJECTIVES

- To understand the concept of stresses and strains and associated deformations of solid bodies due to various loading conditions with the application to bars, beams, columns, etc.
- To understand the concept of shear force, bending moments, slope and deflection of different beams under various loadings.
- To understand the concept of determinate structures and their equilibrium conditions.
- To understand the behaviour of torsion, thin and thick cylinders, and springs.

UNIT I Simple Stresses and Strains

Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain - Relationship between elastic constants.

UNIT II Shear Force and Bending Moment

Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT III Flexural and Shear Stresses

Flexural stresses - Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV Slope and Deflection, Torsion and Springs

Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Torsion - Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

Analysis of close-coiled-helical springs.

UNIT V Thin and Thick Cylinders

Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

TEXT BOOKS

1. Bansal R.K, *Strength of Materials*, Lakshmi Publications, Chennaii, 2010.
2. Rajput R.K, *Strength of Materials*, S.Chand& Co., Delhii, 2007.

REFERENCES

1. Punmia B.C,et al. *Strength of Materials and Theory of Structures - Vol.I,* Lakshmi Publications, Chennai, 2000.
2. Sadhu Singh, *Strength of Materials,* Khanna Publishers, Delhi, 2013.
3. Ramamrutham S, *Strength of Materials,* DhanpatRai Publishing Company, Delhi, 2011.
4. Gambihir M.L, *Fundamentals of Solid Mechanics*,PHI Learning Pvt.Ltd.,New Delhi, 2009.
5. Timoshenko and Gere, *Mechanics of Materials*, Van NosReinbhold, New Delhi, 1995.
6. Bhavikatti S.S, *Solid Mechanics*, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.

COURSE OUTCOMES

On completion of the course, the student will be able to:

1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components;
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures
3. Analyze solid mechanics problems using classical methods and energy methods
4. Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams
5. Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	2	1		1		1			1	3	2	2	
CO2	3	3	3	3	1		1		1			1	3	3	2	
CO3	3	3	3	3	1		1		1			1	3	3	2	
CO4	3	3	3	3	1		1		1			1	3	3	2	
CO5	3	3	3	2	1		1		1			1	3	3	2	

CZPC403	ENGINEERING ECONOMICS, ESTIMATION & COSTING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To equip the students with current practices in government policies and applications.
- To understand the basic principles, economics, cost and material estimates.
- To identify the methods adopted for different structural components.
- To impart knowledge on valuation practices necessary to make the student a complete civil engineer.
- To learn the bidding, contract and tender procedures.

UNIT I

Basic Principles and Methodology of Economics. Demand/Supply – elasticity Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes - Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.

UNIT II

Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method - Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

UNIT III

Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.

UNIT IV

Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

UNIT V

Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management - Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Term Work Assignments:

1. Deriving an approximate estimate for a multi-storeyed building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
    a. Ground plus three storied RCC Framed structure building with block work walls
    b. bridge with minimum 2 spans
    c. factory building
    d. road work
    e. cross drainage work
    f. Ground plus three storied building with load-bearing walls
    g Cost of finishes, MEP works for (f) above
3. Preparation of valuation report in standard Government form.
4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Preparation of Bar bending schedule.

TEXT BOOKS

1. Mankiw Gregory N., "*Principles of Economics",* Thompson Asia Publisher, 2002.
2. V. Mote, S. Paul, G. Gupta, "*Managerial Economics",* Tata McGraw Hill Publisher, 2004.

REFERENCES

1. Misra, S.K. and Puri, "*Indian Economy",* Himalaya Publisher, 2009.
2. Pareek Saroj., "*Textbook of Business Economics",* Sunrise Publishers, 2003.
3. M Chakravarty, *"Estimating, Costing Specifications & Valuation".*
4. Joy P K, *"Handbook of Construction Management",* Macmillan
5. B.S. Patil, "*Building & Engineering Contracts".*
6. Relevant Indian Standard Specifications.
7. World Bank Approved Contract Documents.
8. FIDIC Contract Conditions.
9. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
10. Typical PWD Rate Analysis documents.
11. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and

Practice including Specification and Valuations, 2016
12. Dutta, B.N., *"Estimating and Costing in Civil Engineering (Theory & Practice"),* UBSPublishers, 2016.

COURSE OUTCOMES

On completion of the course, the students will

1. Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
2. Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
3. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
4. Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
5. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure and how competitive bidding works and how to submit a competitive bid proposal.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2					1	1				2	1	1	1		1
CO2				2		1					1			2	1	1
CO3				1		1					1			1	1	1
CO4						2			1		3			1		2
CO5	2				3	1					2	1	1	1	1	1

CEPC404	APPLIED HYDRAULICS ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the students to various hydraulic engineering problems like open channel flows and their computations.
- To understand the methods of dimensional analysis.
- To impart knowledge on characteristics and working principles of hydraulic machines.

UNIT I

Types of flow in open channels – geometrical properties of channel sections – velocity distribution in a channel section – Chezy's formula – Manning's formula – Most economical sections of a channel – rectangular, trapezoidal, triangular and circular sections – uniform flow computations – specific energy and critical depth – critical flow and its computation.

UNIT II

Gradually varied flow – dynamic equation – classification of channel bottom slopes – classification of water surface profiles – characteristics of surface profiles – integration of the varied flow equation by the step method.

Hydraulic jump in rectangular channels – types of hydraulic jumps – surges in open channels – positive and negative surges.

UNIT III

Dimensions – Dimensional homogeneity – Methods of dimensional analysis – Rayleigh's method – Buckingham's π-method – use of dimensional analysis.

Model investigation – similitude – types of similarities – dimensionless numbers – Reynolds, Froude, Euler, Mach and Weber numbers – Model laws – types of models – application of dynamic similarity to specific model investigations – submerged objects and partially submerged objects.

UNIT IV

Impulse-momentum principle – dynamic force exerted by fluid jet on stationary flat plate: (a) plate normal to jet (b) inclined plate – force on moving flat plate – force on curved stationary plate – force on single moving curved plate – fluid jet on moving curved surface of a turbine blade – velocity diagrams for turbine blades – work done on tangential flow runner – jet propulsion – propulsion of ships – forces caused by flow round a pipe-bend – angular momentum equation – radial flow over turbine blade – work done by radial runner.

Different classification of turbines – Pelton turbine: main components and their functions – design of component parts of Pelton turbine – force, power and efficiency – Francis turbine: different types – main components – design of components – torque, power and efficiencies – Kaplan turbine: components – force, torque, power and efficiencies – governing of water turbines – selections of turbines.

UNIT V

Pumps – classification of pumps – working principle of single acting and double acting pumps – slip and coefficient of discharge – rate of delivery – velocity and acceleration of water – speed indicator diagrams – effect of bent delivery pipe on separation – air vessels – suction in pumps with air vessels – pressure in cylinder on delivery stroke with air vessels – maximum speed of pump with air vessel – power required to drive the pump fitted with air vessels.

Comparison with reciprocating pumps – principle and operation – different classifications of centrifugal pumps – specific speed – layout, accessories and starting of centrifugal pumps – static head, manometric head and gross head – power – overall efficiency – loss of head in pipes and fittings – fundamental equations of centrifugal pumps – work done and manometric efficiency – minimum starting speed – priming of pumps – cavitation in pumps – NPSH – multi-stage pumps – deep well pumps.

TEXT BOOKS

1. Jagdish Lal, “Hydraulic machines”, Metropolital Book Co. Pvt. Ltd. Reprint 2011.
2. Subramanya. K., “Flow in open channels”, Tata McGraw Hill, New Delhi 2000.

REFERENCES

1. Ven Te Chow, “Open Channel Hydraulics”, McGraw Hill, New York, 2009.
2. Mays. L. W., “Water Resources Engineering”, John Wiley and Sons (WSE), New York, 2005.
3. Jain. A.K., “Fluid Mechanics”, Khanna Publishers, New Delhi. 2010.
4. Srivastava. R., “Flow through open channels”, Oxford University Press, New Delhi, 2008.
5. Modi. P.N. and Seth. S.M., “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi, 2002.

COURSE OUTCOMES

At the end of the course students will be able to

1. Relate the theory and practice of problems in hydraulic engineering.
2. Apply knowledge of fluid mechanics in addressing open channel flow problems.
3. Solve problems in uniform, gradually varied and rapidly varied flows in steady state conditions.
4. Understand the working principle of pumps.
5. Understand the working principle of turbines.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2											3	1		
CO2	3					1	1						2	1		
CO3	3	2											3	1		
CO4	3								2				2			
CO5	3								2				2			

CZPC405	STRUCTURAL CONCRETE DESIGN I	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the different types of Philosophies related to design of basic RCC structural elements such as slab, beam and column which forms the part of any structural system with reference to Indian Standard Code of Practice.

UNIT I

Objectives of RCC structural design – Structural systems- Structural analysis and Design – Use of Design codes and Hand books – Stress-strain curves of concrete and steel as per IS:456-2000 and ACI 318-14 – Modulus of Elasticity of concrete and steel. Design Philosophies-Working stress method-assumptions- Concept of transformed sections-modular ratio- permissible stresses- Stress block characteristics. Ultimate Load method-assumptions- Stress block characteristics. Limit State method-assumptions- Partial Safety Factors for Materials-Partial Safety Factors for loads- Ultimate limit state – Serviceability limit state - Stress block characteristics. Moment of resistance expressions for balanced, under and over reinforced rectangular sections for rectangular beams using working stress method-Simple problems.

UNIT II

Flexure **:** Analysis and Design of Singly Reinforced rectangular beams, Flanged beams (T& L beams)-Doubly Reinforced rectangular beams – Limit state method – Roof beams, Cantilever beams - Lintel beams- Plinth beams. Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

UNIT III

Shear**:** Shear stresses distribution in rectangular beams-Shear stresses distribution in flanged beams -Shear stresses distribution in rectangular beams due to torsion - Design shear strength of concrete- Flexural shear-Codal provisions for rectangular and flanged sections- Problems. Bond - Factors affecting bond resistance. As per IS456:2000- Check for development length- Serviceability limit state– Deflection computations-short term and long term-Check for Crack width. Design of one and two way slabs - Circular slabs – Cantilever slabs- Dog legged staircase as per IS456:2000 standards-Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993. (Design of flat slab – direct method; Circular slab; Slab type staircase, Placement of reinforcement in slabs - voided slab.

UNIT IV

Design of Short and Slender Columns as per IS456:2000 standards – Design of Columns subjected to axial compression and uni-axial bending – Columns subjected to axial compression and biaxial bending – Axial load verses moment Interaction charts as per SP-16-1978- Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

UNIT V

Design of Isolated rectangular footings with concentric column loads– Design of Isolated rectangular footings with eccentric column loads - Design of Circular footings with concentric column loads - Design of combined footings- Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

TEXT BOOKS

1. Unnikrishna Pillai.S and Devdas Menon*, "Reinforced Concrete Design"*, Third edition, Tata McGraw Hill Publisher, New Delhi, Reprint 2017.
2. Krishnaraju.N, "*Advanced R.C.Design"*, Tata McGraw Hill Publisher, New Delhi 1995.

ReferenceS

1. Shah.V.L& Karve, "*Illustrated R.C. Design"*, Structures Publications, Pune, 2010.
2. Mallick.S.K&Gupta.A.P, "*Reinforced Concrete"*, Oxford I B H, New Delhi, 1987.
3. Ramamrutham.S and Narayan.R, "*Design of R.C. Structures"*, DhanpatRai & Sons, Delhi, 1993.
4. Punmia.B.C, *"R.C Structures*" - Vol.I &II, Lakshmi Publications, Chennai 1992.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards, New Delhi.
3. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
4. SP 16: 1978, Design Aids to IS456: 1978, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the end of the course students will be able

1. To understand the behaviour of steel and concrete structures.
2. To develop and strengthen the knowledge on physical, mechanical and inherent properties of concrete and reinforcing materials and to design practical reinforced concrete structural components.
3. To understand the fundamental application of structural loads, stresses and to design the structural elements using various design philosophies.
4. To acquire the knowledge about the state of the art principles, procedures and current Indian Code requirements for the design of reinforced concrete structural elements.
5. To understand the concept of detailing of reinforced concrete structural elements as per the Indian Codes.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	1							3	3	3	2	
CO2	3	3	3	2	2							3	3	3	2	
CO3	3	3	3	2	1							3	3	3	2	
CO4	3	3	3	2	1							3	3	3	2	
CO5	3	3	3	2	1							3	3	3	2	

CZPC406	SURVEYING & GEOMATICS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To describe the function of surveying in civil engineering construction.
- To apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
- To measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments.
- To calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse.

UNIT I Introduction to Surveying

Principles, Linear, angular and graphical methods, Survey stations, Survey lines-ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling-booking and reducing levels; differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes.

Triangulation and Trilateration: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines -corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric levelling - Axis single corrections.

UNIT II Simple and Compound Curves

Elements of simple and compound curves – Method of setting out–Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve -Vertical curves

UNIT III Modern Field Survey Systems

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT IV Photogrammetry Surveying

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

UNIT V Remote Sensing

Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

TEXT BOOKS

1. Madhu, N, Sathikumar, R and Satheesh Gobi, *"Advanced Surveying: Total Station, GIS and Remote Sensing",* Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, *"Geomatics Engineering",* Nem Chand & Bros, 2011.

REFERENCES

1. Bhavikatti, S.S., "*Surveying and Levelling",* Vol. I and II, I.K. International, 2010.
2. Chandra, A.M., *"Higher Surveying",* Third Edition, New Age International (P) Limited, 2002.
3. Anji Reddy, M., *"Remote sensing and Geographical information system",* B.S. Publications, 2001.
4. Arora, K.R., *"Surveying, Vol-I, II and III",* Standard Book House Publishing, 2015.

COURSE OUTCOMES

The course will enable the students to

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
2. Translate the knowledge gained for the implementation of Civil infrastructure facilities
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.
4. Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods.
5. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				2				2				2		1	
CO2	3				2				2				2		1	
CO3	3				3				2				2		2	
CO4	3				2				2				2		1	
CO5	3				3				2				2		2	

CZCP407	STRUCTURAL MATERIAL TESTING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To provide practical training on the testing and studying the stress –deformation response under axial and transverse loading conditions of conventional engineering materials like steel and wood.

LIST OF EXPERIMENTS

1. Tension test on Steel rods
2. Double Shear test on Steel rods
3. Deflection test on Steel and Wooden beams
4. Compression test on wooden specimen
5. Impact tests
6. Hardness tests on different metals
7. Test on Helical springs
8. Torsion Test.

REFERENCES

1. Bansal.R.K, "*Strength of Materials"*, Lakshmi Publications, New Delhi, December 2005.
2. Rajput.R.K, "*Strength of Materials"*, S.Chand& Co., New Delhi, September 2000.
3. Punmia.B.C, et al **, "***Strength of Materials and Theory of Structures" - Vol.I,* Laxmi Publications, Chennai, 2000.
4. Sadhu Singh, "*Strength of Materials",* Khanna Publishers, Delhi, 1988.
5. Ramamrutham.S, "*Strength of Materials", DhanpatRai Son,* New Delhi, 1992.
6. Hiraskar.G.K**, "***Strength of Materials"*, Khanna, Delhi, 1984**.**

COURSE OUTCOMES

At the end of the course students will be able

1. To find out the material properties.
2. To find out the stress, strain, young's modulus, Poisson's ratio, etc. for different materials.
3. To understand the materials behaviour by their properties.
4. To determine the hardness of materials
5. To determine the stiffness of the springs.

Mapping of COs with POs													Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3				1								2		1	
CO2	3				1								2		1	
CO3	3				1								2		1	
CO4	3				1								2		1	
CO5	3				1								2		1	

CECP408	HYDRAULIC ENGINEERING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To apply their knowledge of fluid mechanics in addressing problems in open channels, will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.

LIST OF EXPERIMENTS

1. Flow Visualization
2. Studies in Wind Tunnel
3. Boundary Layer
4. Flow around an Aerofoil / circular cylinder
5. Uniform Flow
6. Velocity Distribution in Open channel flow
7. Venturi Flume
8. Standing Wave Flume
9. Gradually Varied Flow
10. Hydraulic Jump
11. Flow under Sluice Gate
12. Flow through pipes
13. Turbulent flow through pipes
14. Flow visualization
15. Laminar flow through pipes
16. Major losses / Minor losses in pipe

REFERENCES

1. P.M. Modi and S.M. Seth, *"Hydraulics and Fluid Mechanics",* Standard Book House.
2. K. Subramanya, "*Theory and Applications of Fluid Mechanics",* Tata McGraw Hill.
3. K. Subramanya, *"Open channel Flow",* Tata McGraw Hill.
4. Ven Te Chow, *"Open Channel Hydraulics",* Tata McGraw Hill.
5. Burnside, C.D., "*Electromagnetic Distance Measurement*," Beekman Publishers, 1971.

COURSE OUTCOMES

1. The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
2. They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
3. They will have knowledge in hydraulic machineries (pumps and turbines).
4. They will be able to identify the flow properties under various conditions.
5. They will be able to calculate the losses in flow.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1		1									3	1	1	
CO2	3	1		1			1						3	2	2	
CO3	3				1				1				2		1	
CO4	3	1											3	1		
CO5	3	1											3	1		

CECP409	SURVEYING & GEOMATICS LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To conduct experiments on Surveying and Levelling.
- To understand the principles of Surveying.
- To know about compass surveying and plane table surveying.
- To understand the concepts of levelling and its applications.
- To understand the concepts of Theodolite surveying.

LIST OF EXERCISES

I Chain Surveying

1. Study of Chains and its accessories
2. Ranging a line and taking offsets
3. Cross-Staff Survey (Area of a traversing by Chain triangulation)

II Compass Surveying

1. Study of prismatic compass and its accessories
2. Determination of area of an extent by radiation methods
3. Determination of distance of two inaccessible points

III Levelling

1. Study of Dumpy level and telescopic staff
2. Simple Levelling – Determination of Reduced levels
3. Differential Levelling - Determination of Reduced levels

IV Theodolite and Trigonometric Surveying

1. Study of transit theodolite, fundamental of various axes
2. Measurement of horizontal angle by repetition method
3. Measurement of horizontal angle by reiteration method
4. Heights and distances

V Tachometric Surveying

1. Determination of tachometric constants
2. Distance and elevation by stadia method
3. Distance and elevation by tangential method
4. Determination of Gradient of a line

Demonstration

1. Study of GPS
2. Study of Total Station.

The syllabus includes a **Survey Camp** for about one week

REFERENCES

1. Kanetkar.T.P & Kulkarni.S.V, "*Surveying - Vol. I & II"*, Vidyarthi Griha Prakashan, Pune, 1968.
2. Punmia.B.C, "*Surveying Volume-1"*, Laxmi Publications, New Delhi, 2005.
3. Arora, "*Surveying - Vol.I & II"*, Standard Publishers & Distributors, New Delhi, 1987.
4. Agor.R, "*Surveying & Levelling"*, Oscar Publications, Delhi, 1984.
5. Rangwala.S.C, "*Surveying and Levelling"*, Charotar Publishing House, Gujarat, 2005.

GEOMATICS LAB (FROM NET)

- Pacing and taping
- Differential levelling
- Familiarization with TS
- Closed traverse
- Construction lab
- Horizontal curve
- GPS
- GIS and auto-cadd
- Plant and profile

COURSE OUTCOMES

At the completion of the course students will be able to

1. Do chain surveying, compass surveying, plane table surveying, and Levelling
2. Carry out Theodolite survey and Tachometric survey.
3. Handle the Survey Instruments, their care and adjustments and the, principles of Chain Surveying.
4. Understand the concept of total station.
5. Carry out the contouring.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3			1					2	1			2	1	1	1
CO2	3				1				2	1			2		1	1
CO3	3								1	1			2			1
CO4	3				2				1	1			2		1	1
CO5	3								1	1			2			1

SEMESTER V

CZPC501	STRUCTURAL MECHANICS I	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the complex analysis of structures with different end conditions.
- To learn the concepts of analysis in arches and cables.
- To have knowledge in the various classical methods of analysis of structures.

UNIT I Indeterminate Structures

Linear elastic Analysis - Degree of Redundancy - Degree of Freedom - Static and Kinematic Indeterminacies – Maxwell's Theorem-Betti's law- Method of consistent deformation- sign convention- Clapeyron's theorem of three moments equation method – Problems with concentrated loads, partial or and full UDL, concentrated moments - Propped Cantilever Beams, Fixed Beams and Continuous Beams (restricted to two spans) - Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD).

UNIT II Indeterminate Structures

Degree of Redundancy - Static and Kinematic Indeterminacies - Plane frames – Virtual work method (Unit Load Method) – Castigliano's Theorems – Simple frames (restricted to three members with two redundancies) - Simple trusses (restricted to five members with two redundancies)- Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD).

UNIT III Influence Lines

Analysis for moving loads - Influence Line Diagram (ILD) – Muller Breslau Principle for Influence Lines- ILD for simply supported beams - ILD for overhanging beams - ILD for Propped cantilever beams with flexural hinges- simply supported beams with floor girders – Problems with single concentrated loads, two loads, train of loads, UDL longer than span and shorter than span – Maximum SFD and BMDs –Absolute maximum bending moment- ILD for Simple Plane truss. ILD for continuous beams and rigid frames (no problems) - Indirect model analysis for indeterminate structures.

UNIT IV Arches

Arch action – Types of Arches - Analysis of Three-hinged and Two-hinged arches with effect of temperature change, rib shortening - Yielding of supports - Influence lines - Parabolic and Circular arches – Settlement effects.

UNIT V Cables and Suspension Bridges

Cables and Suspension bridges – Cable Theorem – Cable under uniformly distributed loads (Cable Equation) - Horizontal thrust on the cable -Tension in the cable -

Length of the cable - Effect of temperature on the cable - Stiffening girders in suspension bridges - Analysis of three-hinged and two-hinged stiffening girders with different support levels. ILD for moving loads over suspension bridges. Analysis of Beams Curved in Plan – Analysis of Space trusses using tension coefficient method.

TEXT BOOKS

1. Punmia.B.C, et al, "*Theory of Structures- Vol.I& II"*, Lakshmi Publications, New Delhi, 2004
2. Ramamrutham.S & Narayan.R, (1993) "*Theory of Structures"*, Dhanpat Rai and Sons, Delhi, 1992.

REFERENCES

1. Devdas Menon, "*Structural Analysis"*, Narosa Publishing House, New Delhi, 2009.
2. Reddy.C.S, "*Basic Structural Analysis"*, Tata McGraw Hill Book Co., New Delhi, 1996.
3. Wang.C.K, "*Intermediate Structural Analysis",* Tata McGrawHillBook Co., New Delhi,1984.
4. Vazirani and Ratwani, "*Analysis of Structures - Vol.I.& II",* Khanna Publishers, Delhi,1996.
5. Viadyanathan. R and Perumal. P, "*Comprehensive Structural Analysis Vol. I & II"*, Laxmi Publications, New Delhi,2003.
6. Negi.L.SandJangid.R.S, "*Structural Analysis"*, Tata McGraw Hill Book Co., New Delhi, 2003.
7. Gambhir, M.L., "*Fundamentals of Structural Mechanics and Analysis"*, PHI Learning Pvt. Ltd., New Delhi,2011.
8. Bhavikatti.S.S, "*Structural Analysis,Vol. I and II",* Vikas Publishing House Pvt. Ltd., New Delhi, 2008.

COURSE OUTCOMES

At the completion of the course students will be able

1. To analyze the indeterminate structures like beams and frames with different end conditions.
2. To analyze the indeterminate structures like beams and frames with different loading conditions.
3. To analyse the arch structures and suspension cable bridges.
4. To solve the structural problems with influence line methods of analysis.
5. To analyse the problems in the various classical methods of analysis of structures

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3				2	3	3	3	2
CO2	3	3	3	3	3	3	2	3				2	3	3	3	2
CO3	3	3	3	3	3	3	2	3				2	3	3	3	2
CO4	3	3	3	3	3	3	2	3				2	3	3	3	2
CO5	3	3	3	3	3	3	2	3				2	3	3	3	2

CZPC502	STRUCTURAL STEEL DESIGN I	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the fundamentals of the design of steel Structures.
- To design simple steel elements and the corresponding fasting systems.

UNIT I

Limit State Design – Basic for Design – Ductility – Partial safety factors for loads – Partial Safety Factors for Materials – Deflection Limits. Bolted connections – Location details of Fasteners – Bearing and Friction Grip type bolts – Long joints – Shear capacity – Tension capacity – Bearing Capacity – Bolts subjected to combined shear and tension – Slip resistance – Tension resistance – Prying force and Tension – In plane loading – Design of connections as per IS 800 – 2007 provisions. Welded connections – Butt joint – Lap joint – Size of weld – Throat thickness – Weld symbols – Weld types – Long joints – Weld subjected to combination of normal and shear stress – combination of bearing bending and shear – In plane loading – Out of Plane loading – Design of connections as per IS 800 – 2007 provisions.

UNIT II

Tension members – Types – Design strength due to yielding of cross section – Rupture of critical section – Plates – Threaded rod single Angles – Other sections – Block shear – Bolted and welded connection of Tension members – Design of Tension members as per IS 800 – 2007 provisions.

UNIT III

Compression members – Effective lengths – Slenderness ratios – Imperfection factor – Stress reduction factor – Bucking class of cross sections – Design details – Column Bases Angle Struts – Laced Columns – Battened columns – Design of compression members as per IS 800 – 2007 provisions.

UNIT IV

Beams – Effective span of Beams – Design strength in Bending Torsional Buckling – Effective Length for simply supported beams – Shear – Beams of unsymmetrical sections – Design of beams as per IS 800 – 2007 provisions.

UNIT V

Welded Plate girders – Components of plate girder – Design of web – Design of flanges – Connections – End bearing stiffness – Intermediate stiffness – Web splices – Flange splices – Design of Welded plate girders as per SP: 6 (2)- 1962 and IS 800 – 2007 provisions.

TEXT BOOKS

1. Subramanian N, "*Design of Steel Structures"*, Oxford University Press, New Delhi, 2008.
2. Bhavikatti S.S, "*Design of Steel Structures"*, I.K. International Publishing House Pvt. Ltd., New Delhi, 2012.

REFERENCES

1. Duggal S.K, "*Limit state Design of Steel Structures"*, Tata McGraw Hill Education Private Ltd, New Delhi, 2000.
2. Sairam K.S, "*Design of Steel Structures"*, Pearson Publications, London 2013.
3. Shiyekar, "*Limit state Design of Steel Structures"*, Phi Learning Pvt. Ltd, Delhi, 2010.

STANDARDS

1. IS 800: 2007, General Construction in Steel, Bureau of Indian Standards, New Delhi.
2. IS 813: 1986, Scheme of symbols for welding, Bureau of Indian Standards, New Delhi.
3. SP: 6(2):1972, Hand book for Structural Engineers, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand the different types of Steel sections available in the market.
2. To design the connections and different types of members subjected to various loading conditions.
3. To understand the Codal provisions for designing the members.
4. To design the compression and tension members as per the requirements
5. To design the plate girders inclusive of the design of flanges and web and their connections.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		3	3				2			1			2	3		1
CO2		3	2										2	3		
CO3		3	2										2	3		
CO4		3	2										2	3		
CO5		3	2										2	3		

CZPC503	SOIL MECHANICS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the nature, properties and behavioral response of soils is essential for a safe and stable design of foundations.
- To understand the principles involved in the understanding of the behavior of soils as a supporting medium for structures.

UNIT I

Physical & Index properties of soil: Weight- Volume Relationships, In-situ Density, Moisture Content, Specific Gravity, Relative Density, Atterberg's Limits, Soil Indices, consistency of soil, Particle Size Distribution of soil: Sieving, Sedimentation Analysis. Identification & Classification of soil: Field identification of soil, Soil Classification: as per Unified Classification System, IS Code Recommendation as per SP 36 – 1 (1987).

UNIT II

Flow through soil: Darcy's Law, Coefficient of permeability, laboratory and field determination of coefficient of permeability, Permeability for Stratified Deposits, Laplace's Equations, Flow nets, Flow Through Earthen Dam, Estimation of Seepage, Uplift due to seepage. Effective Stress Principles: Effective Stress, Effective pressure due to different conditions, Seepage force, Critical hydraulic gradient, Quick sand condition, Design of filters, Capillarity in soil.

UNIT-III

Stress Distribution In Soil: Normal and shear stresses, Stress due to point loads, Stress beneath Line, strip & uniformly loaded circular area & rectangular area, pressure bulbs, Newmark's charts- Use for determination of stress due to arbitrarily loaded areas.

UNIT-IV

Compaction of soil: Principles of Compaction, Compaction Test, Field Compaction, Various methods of field compaction and control. Compressibility & Consolidation of Soil: Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils: Compression index, Coefficient of compressibility & volume change, Coefficient of consolidation, Degree & rate of consolidation, Laboratory method of one dimensional consolidation test, Determination of consolidation parameters, Secondary consolidation.

UNIT-V

Shear Strength of Soil: Basic concepts, Mohr- Columb's Theory, Laboratory Determination of soil shear parameter- Direct Shear, Tri-axial Test, Unconfined Compression, Vane Shear Test, Sensitivity & thixotropy of clay as per SP 36 – 1 (1987).Slope failure mechanisms - total stress analysis for saturated clays - friction circle method, tension cracks - use of stability number.

TEXT BOOKS

1. Punmia B.C, "*Soil Mechanics & Foundation Engineering",* Lakshmi Publications, New Delhi, 2005.
2. Moorthy V.N.S., "*Soil Mechanics & Foundation Engineering", CRS Press,* Taylor & Francis Books India Pvt. Ltd, New Delhi, *2002.*

REFERENCES

1. ShamsherPrakash, "*Problems in Soil Mechanics", Asia Publishing House,* Hyderabad, 1972*.*
2. Terzaghi, K. and Peck.R.B, "*Soil Mechanics in Engineering Practice", John Wiley & Sons, Navi Mumbai, 1996.*
3. Venkatramaiah. C, *Geotechnical Engineering", New Age International Publishers,* New Delhi, 2006.
4. Arora, "*Soil Mechanics & Foundation Engineering", Standard Publishers Distributors,* New Delhi, 2005.

STANDARDS

1. SP 36 – 1:1987 Compendium of Indian Standards on Soil Engineering: Part-1 Laboratory Testing of Soils for Civil. Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

At the end of the course students will be able

1. To understand the soil characters such as shear strength and stress distribution.
2. To determine the soil properties.
3. To demonstrate the experiments on different soils.
4. To understand the stress distribution under the soils.
5. To understand the shear strength and uplift due to seepage.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2												1			
CO2	2	3											3	1		
CO3			3											1		
CO4	1	3											2	1		
CO5	1	3	2		3								2	2	1	

CZPC504	STRUCTURAL CONCRETE DESIGN II	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concepts of advanced structural design of building frames, raft foundations, pile foundations and water tanks.
- To enhance the structural design skill to develop confidence in structural design.

UNIT I

Analysis and design of concrete Building frames: load combinations for gravity and lateral loads (wind or seismic)- Substitute frame method for gravity loads - Portal and Cantilever methods for lateral loads - Analysis and design of two storied two bay concrete Plane frames under gravity and lateral loads- Reinforcement detailing as per SP 34 : 1987 and IS 13920: 1993.

UNIT II

Design of Raft foundation (IS:2950 (Part I) -1981) - Design of Strap footings - Reinforcement detailing as per SP 34 : 1987.

UNIT III

Design of Under-reamed piles with two bulbs(IS : 2911 (part III) – 1980), Design of Bored Pile foundations with Pile cap for two column loads, three column loads, four column loads IS: 2911 (Part 1/Sec 2)- 2010 – Reinforcement detailing as per SP 34 : 1987.

UNIT IV

Design of square, rectangular and circular shape water tanks resting on ground - Design of square, rectangular and circular shape water tanks resting underground(IS 3370 (Part IV) : 1967) - Reinforcement detailing as per SP 34 : 1987. Design of Concrete Domes - Reinforcement Detailing as Per SP:34 -1987. Introduction to bridge engineering, Investigation for bridges, IRC loadings, Design of slab culvert; Design of Masonry walls and columns.

UNIT V

Design of cantilever type retaining walls without surcharge - Design of cantilever type retaining walls with surcharge and traffic loads - Design of counter-fort type retaining walls without surcharge - Design of counter-fort type retaining walls with surcharge and traffic loads - Reinforcement detailing as per SP 34: 1987.

TEXT BOOKS

1. Krishnaraju.N, "*Advanced R.C.Design"*, CBS Publishers & Distributors Pvt Ltd, New Delhi 2012.
2. Punmia.B.C, "*R.C.Structures - Vol.I & II",* Laxmi Publications (P) LTD, New Delhi 1995.

REFERENCES

1. Ramamrutham.S and Narayan.R, "*Design of R.C. Structures",* Dhanpat Rai and Sons, Delhi, 1992
2. Dayaratnam P, "*Design of RC Structures"*, OXFORD & IBH Publishing Co, New Delhi, 2000.
3. Punmia.B.C, "*R.C.Structures – Vol. II"*, Standard Publishers, New Delhi, 1991.
4. Mallick.S.K & Gupta.A.P, "*Reinforced Concrete"*, Oxford I B H, New Delhi, 1987.
5. Park and Paulay. T, "*R.C.Structures"*, Tata McGraw Hill Publications, New Delhi, 1975.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code Of Practice, Bureau of Indian Standards, New Delhi.
3. SP 34: 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4. IS: 2950 (part I) -1981, Code of Practice for Design and Construction of Raft Foundations, Bureau of Indian Standards, New Delhi.
5. IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils : General Requirements, Bureau of Indian Standards, New Delhi.
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code of Practice, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundations (Under-reamed piles), Bureau of Indian Standards, New Delhi.
8. IS 3370 (Part IV) :1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

1. The students will have the knowledge of analysis and design of multi-storeyed frames with lateral loads
2. The students will have the knowledge of analysis and design of the pile foundation.
3. The students will have the knowledge of analysis and design of the strap footings and raft foundation.
4. The students will have the knowledge of analysis and design of the water tanks of different sizes for various staging conditions.
5. The students will have the knowledge of analysis and design of the retaining walls of different types.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	1	2							3	3	2	2	
CO2	3	2	3	1	2							3	3	3	2	
CO3	3	2		1	2							3	3	2	2	
CO4	3	2	3	1	2							3	3	3	2	
CO5	3	2	3	1	2							3	3	3	2	

CZCP507	COMPUTER PRACTICAL II	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in the use of latest software's available to solve structural engineering problems and documentations procedures.

LIST OF EXERCISES

Plate 1. Draw cross section, longitudinal sections of Concrete Beams with reinforcement details as per SP 34: 1987, IS 13920: 1993.
   a. Singly and Doubly Reinforced Concrete Beams
   b. Flanged beam: T and L shaped Reinforced Concrete Beams
   c. Rectangular Continuous Beams
   d. Lintel Beams with sunshade
   e. Plinth Beams
   f. One way and two way slabs.
   g. Continuous slabs

Plate 2. Draw cross section, longitudinal sections of Concrete staircase with reinforcement details as per SP 34: 1987, IS 13920: 1993.
   a. Dog legged staircase

Plate 3. Draw cross section, longitudinal sections of Column with Footings and reinforcement details as per SP 34: 1987, IS 13920: 1993.
   a. Rectangular Column with Isolated Footings
   b. Circular Column with Circular Isolated Footings

Plate 4&5. Draw cross section, longitudinal sections and reinforcement details for the followings
   a. Strap footing
   b. Raft foundation (IS: 2950 (Part I) -1981).

Plate 6, 7 & 8. Draw cross section, longitudinal section and reinforcement details as per IS: 2911 (Part 1/Sec 1) - 2010, IS 2911 (Part III): 1980 and SP 34: 1987.
   a. Pile with Pile cap (Two pile group)
   b. Pile with Pile cap (Three pile group)
   c. Pile with Pile cap (Four pile group)

Plate 9 & 10. Draw cross section, longitudinal sections and reinforcement details as per SP 34: 1987.
   a. Cantilever Type Retaining Wall
   b. Counter fort Type Retaining Wall

REFERENCES

1. ACAD Manuals.
2. Krishnaraju.N, "*Structural Design and Drawing",* Oscar Publications, Delhi, 2005.
3. Punmia, B.C, "*Reinforced Concrete Structure Vol. I"*, Standard Publishers Distributors, New Delhi, 2007.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi

3. SP 34 : 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4. IS: 2950 (Part I) -1981, Code of Practice for Design and Construction of Raft Foundations, Bureau of Indian Standards, New Delhi
5. IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils: General Requirements, Bureau of Indian Standards, New Delhi
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code of Practice, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation (Under-reamed piles),Bureau of Indian Standards, New Delhi,
8. IS 3370 (Part IV): 1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be

1. Having the knowledge of how to represent the detailing in the form of drawings for practical applications.
2. Draw the detailed drawings showing reinforcement details.
3. Able to gain experience/ practice on Modern Software in Civil Engineering field.
4. Able to give the reinforcement detailing for the structures like foundations, water tanks, retaining walls, etc.
5. Able to understand the codal provisions for detailing of reinforcements and how to implement in the drawings.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		2				2	1		2			2	2		1
CO2	3		2				2	1		2			2	2		1
CO3	2				3								1		2	
CO4	3		3		2		2	1		1			2	2	1	1
CO5	3				2							2	2		1	

CZCP508	GEOTECHNICAL ENGINEERING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in various aspects of soil investigation.
- To determine the basic soil properties, strength, deformation and permeability characteristics of soils through which the students can try to be successful geotechnical engineers.

LIST OF EXERCISES

1. Field Density using Core Cutter method.
2. Field Density using Sand replacement method.
3. Natural moisture content using Oven Drying method.
4. Field identification of Fine Grained soils.
5. Specific gravity of Soils.
6. Grain size distribution by Sieve Analysis.
7. Grain size distribution by Hydrometer Analysis.
8. Consistency limits by Liquid limit
9. Consistency limits by Plastic limit
10. Consistency limits by Shrinkage limit.
11. Permeability test using Constant-head test method.
12. Permeability test using Falling-head method.
13. Compaction test: Standard Proctor test.
14. Compaction test: Modified Proctor test.
15. Relative density.
16. Consolidation Test.
17. Triaxial Test (UU)
18. Vane shear test
19. Direct Shear Test
20. Unconfined Compression Strength Test.

REFERENCES

1. Craig R.F., Chapman & Hall, "*Soil Mechanics"*
2. Taylor, John Wiley & Sons, *"Fundamentals of Soil Engineering".*
3. Holtz R.D. and Kovacs, W.D., Prentice, *"An Introduction to Geotechnical Engineering",* Hall, NJ.
4. Braja M. Das, Cengage Learning, "*Principles of Geotechnical Engineering",*
5. Braja M. Das, Cengage Learning, "Principles of Foundation Engineering"
6. David F. McCarthy, "Essentials of Soil Mechanics and Foundations: Basic Geotechnics"
7. Karl Terzaghi, Ralph B. Peck, and Gholamreza, "Soil Mechanics in Engineering Practice" Mesri.
8. V.N.S. Murthy, "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering)".

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand the soil properties.
2. To gain knowledge about the soil characterstics.
3. To conduct the different experiments according to the soil types for finding their properties.
4. To classify the soils by its sizez and type.
5. To know the consistency limits of soils and consolidation process for the usefulness of practical applications.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3											2	1		
CO2		3	2										2	3		
CO3		1	2	3									1	1	2	
CO4		1	3	1									1	2	1	
CO5			3	2										1	1	

CZCP509	STRUCTURAL REINFORCEMENT DETAILING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students to know an appropriate detailing of every structural elements involved in field of structural engineering problems and documentations procedures.

LIST OF EXERCISES

1. Draw cross section, longitudinal sections of Concrete Beams with reinforcement details as per SP 34: 1987, IS 13920: 1993.
   i. Singly and Doubly Reinforced Concrete Beams
   ii. Flanged beam: T and L shaped Reinforced Concrete Beams
   iii. Rectangular Continuous Beams
   iv. Lintel Beams with sunshade
   v. Plinth Beams
   vi. One way and two way slabs.
   vii. Continuous slabs
2. Draw cross section, longitudinal sections of Concrete staircase with reinforcement details as per SP 34: 1987, IS 13920: 1993.
   i. Dog legged staircase
3. Draw cross section, longitudinal sections of Column with Footings and reinforcement details as per SP 34: 1987, IS 13920: 1993.
   i. Rectangular Column with Isolated Footings
   ii. Circular Column with Circular Isolated Footings

4 & 5. Draw cross section, longitudinal sections and reinforcement details for the followings
   i. Strap footing
   ii. Raft foundation (IS: 2950 (Part I) -1981).

6, 7 & 8. Draw cross section, longitudinal section and reinforcement details as per IS: 2911 (Part 1/Sec 1) - 2010, IS 2911 (Part III): 1980 and SP 34: 1987.
   i. Pile with Pile cap (Two pile group)
   ii. Pile with Pile cap (Three pile group)
   iii. Pile with Pile cap (Four pile group)

9 &10. Draw cross section, longitudinal sections and reinforcement details as per SP 34: 1987.
   i. Cantilever Type Retaining Wall
   ii. Counter fort Type Retaining Wall

REFERENCES

1. ACAD Manuals.
2. Krishnaraju.N, "*Structural Design and Drawing",* Oscar Publications, Delhi, 2005.
3. Punmia, B.C, "*Reinforced Concrete Structure Vol. I"*, Standard Publishers Distributors, New Delhi, 2007.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to

Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
3. SP 34 : 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4. IS: 2950 (Part I) -1981, Code of Practice for Design and Construction of Raft Foundations, Bureau of Indian Standards, New Delhi
5. IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils: General Requirements, Bureau of Indian Standards, New Delhi
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code of Practice, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation (Under-reamed piles),Bureau of Indian Standards, New Delhi,
8. IS 3370 (Part IV): 1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be

1. Having the knowledge of how to represent the detailing in the form of drawings for practical applications.
2. Draw the detailed drawings showing reinforcement details.
3. Able to gain experience/ practice on Modern Software in Civil Engineering field.
4. Able to give the reinforcement detailing for the structures like beams, columns, footings, foundations, water tanks, retaining walls, etc.
5. Able to understand the codal provisions for detailing of reinforcements and how to implement in the drawings.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2							1	1		3	2		1
CO2	3	1	3	2									2	2	1	
CO3	3				3								2		2	
CO4	3	1	3	2									2	2	1	
CO5	3		2							2			2	1		1

ETIT510	INDUSTRIAL TRAINING / RURAL INTERNSHIP / INNOVATION / ENTREPRENEURSHIP	L	TR	S	C
		-	1	2	2

COURSE OBJECTIVES

4. To encourage the students to study advanced engineering developments.
5. To Prepare and present technical reports.
6. To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATIONS

7. During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
8. In a session of 3 periods per week, 15 students are expected to present the seminar.
9. Each student is expected to present at least twice during the semester and the student is evaluated based on that.
10. At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
11. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
12. Evaluation is 100% Internal.

COURSE OUTCOMES

1. The students know the advanced engineering developments.
2. Able to Prepare and present technical reports.
3. Able to use various teaching aids such as over head projectors, power point presentation and demonstrative models.
4. Able to present infront of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.

Mapping of COs with POs													Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1				1	3	3		1		3		2
CO2	3	3	3	3		2			3	3	2	1	1	2	2	3
CO3	3	3	3		2	1	2		3	3	1		3	3	2	2
CO4							3	3	3	2				1		2
CO5	3	2	1						3	3	1	1	1	2	3	3

SEMESTER VI

CZPC601	STRUCTURAL MECHANICS II	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the complex analysis of indeterminate structures with different end conditions. Through various classical methods of analysis of indeterminate structures.
- To provide advanced and modern methods of structural analysis of simple and complicated structures and structural systems.
- To learn the concept of force method and displacement method of analysis using matrix approach.
- To have the knowledge of plastic analysis of concrete structures.

UNIT I Slope Deflection Method

Slope deflection equations- sign convention - Continuous beams (two spans only) – Simple Plane frames with and without sway (three members only) - Problems with flexural hinges, elastic supports support settlements and non prismatic fixed beams- Problems using Symmetry and Anti-symmetry concepts.

UNIT II Moment Distribution Method

Moment Distribution method (Prof. Hardy Cross Method) – Joint stiffness- Distribution factors- Carry over factors - Analysis of continuous beams – simple Plane frames with and without sways – Problems with flexural hinges, elastic supports and support settlements.

UNIT III Flexibility Method

Flexibility or Force equation - Member flexibility – Flexibility coefficients – Equivalent Joint Loads- Choice of Redundant force restricted to two - Analysis of continuous beams, frames (two redundant forces), Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements.

UNIT IV Stiffness Method

Stiffness or Displacement equation - Member stiffness – Stiffness coefficients – Element and Global stiffness matrices - Transformations of stiffness matrices, load vectors and displacements vectors- Choice of displacements restricted to two - Analysis of continuous beams, frames, Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements.

UNIT V Approximate Method

Approximate methods: substitute frame method for gravity loads – Portal and cantilever methods for lateral loads. Simple frames used for water tanks, industrial bends, bunkers and silos staging. Plastic Bending Beams- Assumptions- Plastic moment of resistance - Plastic Modulus Shape and Load factors-Plastic hinge and mechanism - Plastic analysis of indeterminate beams and frames - Upper and lower bound theorems.

TEXT BOOKS

1. DevdasMenon, "*Structural Analysis"*, Narosa Publishing House, New Delhi, 2009.
2. Bhavikatti.S.S, "*Structural Analysis Vol. I and II",* Vikas Publishing House Pvt.Ltd., New Delhi, 2008.

REFERENCES

1. Punmia.B.C, et al, "*Theory of Structures- Vol.I& II"*, Lakshmi Publications, New Delhi, 2004.
2. Wang.C.K, "*Intermediate Structural Analysis",* Tata McGraw Hill Book Co, New Delhi, 1984.
3. Negi.L.S and Jangid.R.S, "*Structural Analysis"*, Tata McGraw Hill Book Co, New Delhi, 2003.
4. Gambhir, M.L., "*Fundamentals of Structural Mechanics and Analysis"*, PHI Learning Pvt. Ltd., New Delhi, 2011.
5. William Weaver Jr.&James M.Gere, "*Matrix Analysis of framed structures"*, CBS Publishers and Distributors, New Delhi, 2004.
6. Viadyanathan. R and Perumal. P, "*Comprehensive Structural Analysis Vol. I & II"*, Laxmi Publications, New Delhi, 2003.
7. Pandit, G.S. & Gupta, S.P. "*Structural Analysis-A Matrix Approach"*, Tata McGraw Hill, New Delhi, 2004.

COURSE OUTCOMES

At the completion of the course students will be able

1. To analyze the indeterminate structures like beams and frames with different end conditions through various advanced and modern methods.
2. To solve the structural problems with matrix approach.
3. To do the plastic analysis for concrete structures.
4. To analyse the problems with approximate methods and compare the results.
5. To have a sound knowledge on the application of these methods in to practical problems.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	1		3	3	3		2		2	3	3	1	3
CO2	3	3	3	1		3	3	3		2		2	3	3	1	3
CO3	3	3	3	1	2	3	3	3		2		2	3	3	2	3
CO4	3	3	3	1	2	3	3	3		2		2	3	3	2	3
CO5	3	3	3	1		3	3	3		2		2	3	3	1	3

CZPC602	DISASTER PREPAREDNESS & PLANNING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

The objectives of the course are

- To understand basic concepts in Disaster Management.
- To Understand Definitions and Terminologies used in Disaster Management.
- To Understand Types and Categories of Disasters.
- To Understand the Challenges posed by Disasters.
- To understand Impacts of Disasters Key Skills.

UNIT I

Introduction-Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation.

UNIT II

Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); man-made disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

TEXT BOOKS

1. Pradeep Sahni, "*Disaster Risk Reduction in South Asia",* Prentice Hall Publisher, 2004.
2. Singh B.K., *"Handbook of Disaster Management: Techniques & Guidelines",* Rajat Publication, 2008.

REFERENCES

1. Ghosh G.K., *"Disaster Management",* APH Publishing Corporation, 2006.
2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
3. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC
4. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
5. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

COURSE OUTCOMES

The student will develop competencies in

1. The application of disaster concepts to management
2. Analyzing relationship between development and disasters.
3. Ability to understand categories of disasters and
4. Realization of the responsibilities to society
5. Mitigate the people and make awareness during disasters.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2					2	2					1	1	2		
CO2	2					2	2						1	2		
CO3						1	2					1		1		
CO4						3	1							2		
CO5						2			2			1		1		

CZCP607	ADVANCED MATERIALS TESTING, EVALUATION & GEOLOGY LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To demonstrate the model analysis to understand the structural elements behaviour.
- To determine the material properties of different cross sections, steel reinforcements, concrete, etc.
- To understand the behaviour of HPC, HSC and SCC.

LIST OF EXPERIMENTS

1. Model analysis
   a. Continuous beam
   b. Portal frame
2. Flexure test on beams of various cross sections.
3. Flexure test on Continuous beam.
4. Sand heap analogy
5. Modulus of Elasticity of concrete
6. Modulus of Elasticity of Steel by Ewing's Extensometer
7. Modulus of Elasticity of Steel by Whitemore's Strain Gauge
8. Modulus of Elasticity of Steel by Electrical Strain Gauge
9. Unsymmetrical bending
10. Concrete durability tests
11. Preparation of HPC using chemicals and test on HPC
12. Preparation of HSC using chemicals and test on HSC
13. Preparation of SCC using chemicals and test on SCC

REFERENCES

1. Sadhu Singh, "*Experimental Stress Analysis",* Khanna Publishers, New Delhi, 2009.
2. Srinath.L.S, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1984.
3. Ray.T.K, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi.
4. Sadhu Singh, "*Applied Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1983.
5. Dally & Riley, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1980.
6. Vazrani & Chandola, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1980.
7. Durelli A.J, "A*pplied Stress Analysis",* Prentice Hall of India, Delhi, 1970.
8. Mehta P.K., and Monteiro, P.J.M., "*Concrete, Microstructure, Properties and Materials"*, Indian Concrete Institute, Chennai, 1997.
9. Shetty M.S., "*Concrete Technology"*, S.Chand & Co., New Delhi, 2002.

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand the behaviour of steel elements for practical application.
2. To get experience in Modal analysis.
3. To understand the development of concrete for durability studies.
4. To determine the material property concrete and steel.
5. To check the property of special concrete like HSC, HPC, SCC, etc.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	3	2								3	3	3	
CO2	3	3	3	3	3								3	3	3	
CO3	2	2	2	2	2								2	2	3	
CO4	3												2			
CO5	3												2			

CZCP608	COMPUTER PRACTICAL III	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- This course enables the students in studying and understanding structural drawings by training them in doing the structural drawings themselves for various structural elements and systems.

LIST OF EXERCISES

Plate 1. Draw cross section and longitudinal sections of a steel roof truss with Connection details as per SP:38–1987.

Plate 2. Draw cross section and longitudinal section of a welded plate girder as per SP: 6 (2) - 1962.

Plate 3. Draw cross section, longitudinal section and reinforcement details of bunkers as per IS 4995 (Part I&II): 1974.

Plate 4. Draw cross section, longitudinal section and reinforcement details of silos as per IS 5503 (Part I):1969.

Plate 5 & 6. Draw cross section, longitudinal sections and reinforcement of water tanks resting on ground details as per IS 3370 (Part IV): 1967 and SP:34-1987.
a. Square or Rectangular
b. Circular

Plate 7 & 8. Draw cross section, longitudinal sections of Underground water tanks and reinforcement details as per IS 3370 (Part IV): 1967 and SP:34- 1987.
a. Square or Rectangular
b. Circular

Plate 9 &10. Draw cross section, longitudinal section and reinforcement details of Elevated Rectangular and Circular water tanks as per IS 3370 (Part IV): 1967 and SP: 34- 1987.

Plate 11. Draw cross section, longitudinal section and reinforcement detailing of a RC grid floor as per IS 456: 2000.

TEXT BOOKS

1. Unnikrishna Pillai .S and Devdas Menon, "*Reinforced Concrete Design"*, Tata McGraw Hill Publications, New Delhi, 1988.
2. Krishnaraju.N, "*Advanced R.C.Design"*, Tata McGraw Hill Publications, New Delhi, 1995.

REFERENCES

1. Shah.V.L&Karve, "*Illustrated R.C. Design"*, Structures Publications, Pune, 1996.
2. Mallick.S.K&Gupta.A.P*, "Reinforced Concrete"*, Oxford and IBM Publishing, New Delhi, 1987.
3. Punmia.B.C, et al, "*R.C. Structures* - Vol.1 &II", Laxmi Publications (P) LTD, New Delhi, 1992.
4. Ramamrutham.S and Narayan.R, "*Design of R.C. Structures"*, Dhanpat Rai & Sons, New Delhi, 1993.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards, New Delhi.
3. SP 34: 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4. IS: 2950 (part I) -1981, Code of Practice for Design and Construction of Raft Foundations, Bureau of Indian Standards, New Delhi.
5. IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils: General Requirements. Bureau of Indian Standards, New Delhi.
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundations (Under-reamed piles).Bureau of Indian Standards, New Delhi.
8. IS 3370 (Part IV): 1967, Code Of Practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
9. IS 4995 (Part I): 1974, Criteria for Design of Reinforced Concrete Bins for the Storage of Granular and Powdery Materials (General Requirements and Assessment of Bin Loads), Bureau of Indian Standards, New Delhi.
10. IS 4995 (Part II) :1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular ad Powdery Materials (Design Criteria),Bureau of Indian Standards, New Delhi.
11. IS 9178 (Part II):1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria), Bureau of Indian Standards, New Delhi.
12. IS 5503 (Part I):1969, General Requirements for Silos for grain storage (Construction requirements), Bureau of Indian Standards, New Delhi.
13. SP: 6 (2) - 1962 Steel beams and plate girders. Bureau of Indian Standards, New Delhi.
14. IS 3370 (Part IV): 1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be

1. Having the knowledge on the detailed codal standards for structural detailing of various structural elements.
2. Able to draw all drawings using ACAD with all basic drafting commands.
3. Able to practice the structural detailing of truss components and welded plate girder as per codel standards through ACAD software.
4. Able to understand and practice the structural detailing of RC grid floor system, bunkers, silos, water tanks resting on ground and elevated water tanks as per codel standards through ACAD software.
5. Having a knowledge in reading the practical drawings available for execution.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1		1		2	2						2	1	1	1	
CO2	1		2		2	2						2	1	1	1	
CO3	1		3		2	2						2	1	2	1	
CO4	1		3		2	2						2	1	2	1	
CO5	1		3		2	2		2				2	1	2	1	1

SEMESTER VII

ETHS701	PROFESSIONAL PRACTICE, LAW & ETHICS	L	T	P	C
		2	-	-	2

COURSE OBJECTIVES

- To make the students understand the types of roles they are expected to play in the society as
- practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession

UNIT I Professional Practice and Ethics

Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards).

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

UNIT II General Principles of Contracts Management

General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public-Private Partnerships; International Commercial Terms.

UNIT III Arbitration, Conciliation and ADR

Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law –Arbitration and expert determination; Extent of judicial intervention; International commercial larbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT IV Engagement of Labour and Labour & other Construction related Laws

Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

UNIT V Law relating to Intellectual Property

Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

TEXT BOOKS

1. B.S. Patil, *"Legal Aspects of Building and Engineering Contracts",* 1974.
2. The National Building Code, BIS, 2017

REFERENCES

1. RERA Act, 2017
2. Meena Rao, *"Fundamental concepts in Law of Contract",* Third Edition, Professional Offset, 2006.
3. Neelima Chandiramani., *"The Law of Contract: An Outline",* Second Edition, Avinash Publications, Mumbai, 2000.
4. Avtarsingh ., *"Law of Contract",* Eastern Book Co. 2002.
5. Dutt., *"Indian Contract Act",* Eastern Law House. 1994.
6. Anson W.R. *"Law of Contract",* Oxford University Press, 1979.
7. Kwatra G.K., *"The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration",* Indian Council of Arbitration, 2005.
8. Wadhera (2004), *"Intellectual Property Rights",* Universal Law Publishing Co.
9. T. Ramappa (2010), *"Intellectual Property Rights Law in India",* Asia Law House
10. Bare text, *"Right to Information Act",* 2005.
11. O.P. Malhotra, *"Law of Industrial Disputes",* N.M. Tripathi Publishers.
12. K.M. Desai, The Industrial Employment (Standing Orders) Act, 1946.
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14. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry,
15. Engineering Construction and Architectural management, V.10,pp 117-127, MCB UP Ltd
16. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and
17. Application
18. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
19. Engineering Ethics, National Institute for Engineering Ethics, USA
20. www.ieindia.org
21. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
22. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm
23. Internet and Business Handbook, Chap 4, CONTRACTS LAW,
24. http://www.laderapress.com/laderapress/contractslaw1.html
25. Contract & Agreements
26. http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
27. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
28. Business & Personal Law. Chapter 7. “How Contracts Arise”,
29. http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
30. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
31. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS,
32. http://www.worldbank.org/html/opr/consult/guidetxt/types.html
33. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02),
34. http://www.sandia.gov/policy/14g.pdf

COURSE OUTCOMES

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

1. What constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
2. Give a good insight into contracts and contracts management in civil engineering, dispute, resolution mechanisms; laws governing engagement of labour.
3. Understand of Intellectual Property Rights, Patents.
4. Understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.
5. To develop good ideas of the legal and practical aspects of their profession.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					2		3				1		2		2
CO2	3					1		3		2	3		1	2		3
CO3	3					2		3						1		2
CO4	3					3	1	3					1	2		2
CO5	3					2		3				2		1		2

CZPC702	INSTRUMENTATION & SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

The objective of this Course is

- To understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decision making.
- To understand the theoretical and practical principles of design of sensor systems.
- To Provide principle knowledge, practical training and measurement best practice for a range of temperature, pressure, electrical, velocity, acceleration and vibration systems

UNIT I Fundamentals of Measurement, Sensing and Instrumentation

Definition of measurement and instrumentation, physical variables, common types of sensors; - LVDT - Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.

UNIT II Strain Gauges and Rosettes

Strain Gauges – Principle, types, performance and uses – Calibration – Temperature compensation – Strain Rosette analysis – Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements – Strain indicators.

UNIT III Sensor Installation and Operation

i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty

UNIT IV Data Analysis and Interpretation

a)Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)

UNIT V Frequency Domain Signal Processing and Analysis

Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal

processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

TUTORIALS

Demonstrating clearly the understanding and use for the sensors and instruments used for the problems posed and inferences drawn from the measurement and observations made along with evaluation report.

TEXT BOOKS

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press

REFERENCES

1. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
2. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

COURSE OUTCOMES

1. To analyze the errors during measurements, specify the requirements in the calibration of sensors and instruments and to describe the noise added during measurements and transmission
2. To describe the measurement of electrical variables
3. To describe the requirements during the transmission of measured signals
4. To construct Instrumentation/Computer Networks
5. To suggest proper sensor technologies for specific applications and to design and set up measurement systems and do the studies

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3		2	2								3	2	2	
CO2	2	3	2	3	3								3	3	3	
CO3	2	3	2	3	3								3	3	3	
CO4	3	2	2	3	3								3	3	3	
CO5	3	3	3	3	3								3	3	3	

CZCP706	INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS AND EARTHQUAKE ENGINEERING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- This course aims at providing practical training in understanding the behaviour of the building elements subjected to earthquake.

A) INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS

LIST OF EXPERIMENTS

- Instrumentation of typical civil engineering members/structures/structural elements
- Use of different sensors, strain gauges, inclinometers,
- Performance characteristics
- Errors during the measurement process
- Calibration of measuring sensors and instruments
- Measurement, noise and signal processing
- Analog Signal processing
- Digital Signal Processing
- Demonstration & use of sensor technologies

B) COURSE OBJECTIVES: (EARTHQUAKE ENGINEERING)

LIST OF EXPERIMENTS

1. Application of accelerometers and their use in structural models
2. Application of digital oscilloscope and their use in structural models
3. Application of signal converter and their use in structural models
4. Free vibration analysis of wooden, Steel and aluminium cantilever beam models.
5. Determination of viscous damping co-efficient for wooden, Steel and aluminium cantilever beam models.

REFERENCES

1. Alan S Morris, *"Measurement and Instrumentation Principles",* Third edition, Butterworth
2. Hienemann, 2001.
3. David A. Bell, *"Electronic Instrumentation and Measurements",* Second edition, Oxford Press. 2007.
4. S.Tumanski, "Principle of Electrical Measurement, Taylor & Francis, 2006.
5. Ilya Gertsbakh, "Measurement Theory for Engineers", Springer Publisher, 2010.
6. Anil K Chopra, "*Dynamics of Structures"*, McGraw-Hill International Edition, New Delhi, 1998.
7. Clough, R.W. and Penzien, J., "*Dynamics of Structures"*, Second Edition, McGraw-Hill International Edition, New Delhi, 1993.
8. Mario Paz, "*Structural Dynamics: Theory and Computation",* Van Nostrand Reinhold, New York, 1985.

COURSE OUTCOMES

1. To analyze the errors during measurements, specify the requirements in the calibration of sensors and instruments and to describe the noise added during measurements and transmission
2. To construct Instrumentation/Computer Networks
3. To understand the dynamic properties.
4. To gain knowledge about the earthquake occurrence and resistance.
5. To analyse the structure under free and forced vibrations.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	3	3	3								3	3	3	
CO2	3	2	2	2	3								3	2	3	
CO3	3	3	2	3	3								3	3	3	
CO4	2	2	3	3	3								2	3	3	
CO5	2	2	2	3	3								2	3	3	

ETIT707	INDUSTRIAL TRAINING / RURAL INTERNSHIP / INNOVATION / ENTREPRENEURSHIP	L	TR	S	C
		-	1	2	2

COURSE OBJECTIVES

7. To encourage the students to study advanced engineering developments.
8. To Prepare and present technical reports.
9. To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATIONS

13. During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
14. In a session of 3 periods per week, 15 students are expected to present the seminar.
15. Each student is expected to present at least twice during the semester and the student is evaluated based on that.
16. At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
17. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
18. Evaluation is 100% Internal.

COURSE OUTCOMES

1. The students know the advanced engineering developments.
2. Able to Prepare and present technical reports.
3. Able to use various teaching aids such as over head projectors, power point presentation and demonstrative models.
4. Able to present infront of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.

Mapping of COs with POs													Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1				1	3	3		1		3		2
CO2	3	3	3	3		2			3	3	2	1	1	2	2	3
CO3	3	3	3		2	1	2		3	3	1		3	3	2	2
CO4							3	3	3	2				1		2
CO5	3	2	1						3	3	1	1	1	2	3	3

SEMESTER VIII

CZPV803	PROJECT WORK AND VIVA-VOCE	L	PR	S	C
		-	8	4	10

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES

On Completion of the project work students will be in a position

1. To take up any challenging practical problems and find solution by formulating proper methodology
2. To Carry out any experimental works on concrete and steel or any other construction material to know the behavior and properties
3. Understand the modelling, analysis and design concepts by taking up a structure.
4. Carryout a different projects like stadium, theatre, multiplex malls, etc for the analysis and design.
5. Carry out water retaining structures, dams and bridges for the analysis and design.

Mapping of COs with POs													Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1							3				2			1		1
CO2						2			3					1		
CO3			1					2						1		1
CO4							3			2		1		1		1
CO5							3	2						1		1

PROFESSIONAL ELECTIVES

CZPE505	HYDROLOGY & WATER RESOURCE ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the interaction among various processes in the hydrologic cycle; application of fluid mechanics and use of computers in solving problems in hydraulic engineering
- To study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
- To understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
- To understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
- To apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering.

UNIT I

Introduction - hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data. *Precipitation* - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India. Abstractions from precipitation - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapo-transpiration, measurement of evapo-transpiration, evapo-transpiration equations, potential evapo-transpiration over India, actual evapo-transpiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

UNIT II

Runoff - runoff volume, SCS-CN method of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows. Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

UNIT III

Water withdrawals and uses – water for energy production, water for agriculture, water or hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration,

consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

UNIT IV

Distribution systems - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods.

UNIT V

Dams and spillways - embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

TEXT BOOKS

1. K Subramanya, *"Engineering Hydrology",* Mc-Graw Hill.
2. K N Muthreja, "*Applied Hydrology",* Tata Mc-Graw Hill.

REFERENCES

1. K Subramanya, *"Water Resources Engineering Objective Questions*", Tata Mc-Graw Hill.
2. G L Asawa, "*Irrigation Engineering",* Wiley Eastern.
3. L W Mays, *"Water Resources Engineering",* Wiley.
4. J D Zimmerman, *"Irrigation",* John Wiley & Sons
5. C S P Ojha, R Berndtsson and P Bhunya, *"Engineering Hydrology",* Oxford.

COURSE OUTCOMES

At the end of the course, students must be in a position to:

1. Understand the interaction among various processes in the hydrologic cycle; Apply the application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering
2. Study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
3. Understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
4. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
5. Apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				2								2			
CO2	3			2	2	1	1						2	1	1	
CO3	2					2	2						1	2		
CO4	2				1	1							1	1		
CO5	2				3								1			

CZPE506	ENGINEERING GEOLOGY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the site characterization and geologic hazard identification and mitigation.
- To know the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects.
- To learn the quantification of processes such as rock slides, soil-slope stability, settlement, and liquefaction.
- To know the collection, analysis, and interpretation of geological data and information required for the safe development of civil works.

UNIT I

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy- Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

UNIT II

Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology- Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Various forms of rocks. IUGS Classification of phaneritic and volcanic rock.. Field Classification chart. Structures. Classification of Igneous rocks on the basis of Chemical composition. Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Felsite, Pegmatite, Hornfels. Metamorphic Aureole, Kaolinization. Landform as Tors. Engineering aspect to granite. Basic Igneous rocks Like Gabbro, Dolerite, Basalt. Engineering aspect to Basalt. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone Metamorphic petrology- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.

UNIT III

Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial

deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits. Strength Behavior of Rocks-Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

UNIT IV

Geological Hazards-Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factorscontrolling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.

UNIT V

Rock masses as construction material: Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behaviour such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description. Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures. Rock Mechanics- Sub surface 9nvestigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of rocks, Bearing capacity of rocks.

TEXT BOOKS

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.

REFERENCES

1. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

COURSE OUTCOMES

At the completion of the course students will understand

1. Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice
2. The fundamentals of the engineering properties of Earth materials and fluids.
3. Rock mass characterization and the mechanics of planar rock slides and topples.
4. Soil characterization and the Unified Soil Classification System.
5. The mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2			2			1		3		2	3	1	1	1	1
CO2	1	2				2			3			3	2	2		
CO3	2		3					1				2	1	1		1
CO4	2			2	2	3	2			2		3	1	2	2	1
CO5	2	2				3		3	2			2	2	2		2

CZPE603	STRUCTURAL STEEL DESIGN II	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students conversant with the design procedures and practices of complex steel structures like industrial structures and Gantry girders as per IS 800 – 2007 procedures.

UNIT I

Wind on Industrial Buildings - Design wind speed and pressure – Internal and external wind pressure coefficients from codes(IS: 875(Part-3) &SP 64: 2001) – Wind forces on members with height - Wind forces on Cladding, Louvers, hoarding structures, Microwave Towers –Wind motion due to Vortex Shedding, dynamic response factor for along wind and across wind. Design of purlins, Rafters, Sag rods and Girds.

UNIT II

Industrial buildings – Types – Elements of an industrial building – Loads on industrial buildings – Roof trusses – Components of a roof truss – Loads on roofs – Analysis and Design of roof truss. Pre- Engineered Buildings– Advantages of PEB over Conventional roof trusses- Tubular Trusses, joint details and tubular scaffoldings. Analysis and design of hoarding structures under dead, live and wind loads condition as per IS 875 (Part3) & SP 64: 2001.

UNIT III

Design of gantry girder – Gantry supporting columns - Columns with battened plate – column with cap plate details –– Stepped columns – Moment Resistant Connections - Beam and column connections – Beam to Beam connections – Braced industrial buildings – Un-braced industrial frames–Base plate with anchor bolt details - Detailing as per IS 800 : 2007.

UNIT IV

Plastic analysis and design – Advantages and disadvantages – Plastic neutral axis – Plastic modulus – Plastic moment of resistance – Shape factor – Load factor – Plastic hinge – Collapse mechanisms – Theorems of plastic analysis – Analysis and Design of beams and simple frames – Limitations – Plastic design Versus Elastic design. Design of castellated beam for bending and shear.

UNIT V

Cold Form light gauge sections - Type of cross section, stiffened, multiple stiffened and un-stiffened element, Design of light gauge compression, tension and flexural members as per IS 802(Part 1 to 3):1995**.**

TEXT BOOKS

1. Duggal.S.K , "*Limit State Design of Steel Structures"*, Tata McGraw Hill Education Private Ltd, New Delhi, 2000.
2. Sairam.K.S, "*Design of Steel Structures"*, Pearson Publications, Chennai, 2013.

REFERENCES

1. Subramanian.N, "*Design of Steel Structures",* Oxford University Press, New Delhi, 2008
2. Bhavikatti.S.S, *"Design of Steel Structures",* I.K. International Publishing House Pvt. Ltd, New Delhi, 2012.
3. Shiyekar, "*Limit State Design of Steel Structures"*, Phi Learning Pvt. Ltd., Delhi, 2010

STANDARDS

1. IS800:2007, General Construction in Steel – Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS 875 (Part3): Wind Loads on Buildings and Structures, Bureau of Indian Standards, New Delhi.
3. Teaching resource materials by INSDAG, Kolkata.
4. IS: 802(Part 1 to 3): 1995 Code of practice for use of cold formed light gauge steel structural members in general building construction, Bureau of Indian Standards, New Delhi.
5. IS 806:1968 Code of practice for use of steel tubes in general building construction, Bureau of Indian Standards, New Delhi.
6. IS 4014 (Part I and II): 1967 Code of practice for steel tubular scaffolding, Bureau of Indian Standards, New Delhi.
7. SP: 6 (2) – 1962, Hand book for structural Engineers, Steel beams and plate girders, Bureau of Indian Standards, New Delhi.
8. SP: 6 (5) – 1980, Hand book for Structural Engineers, Structural use of light gauge steel, Bureau of Indian Standards, New Delhi.
9. IS codes for Aluminium Structures, IS:3908, 3909, 3921, 5384, 6445, 6476, 6475, 6449, 8147, Bureau of Indian Standards, New Delhi.
10. SP 64 (2001): Explanatory Handbook on Indian Standard Code of Practice for Design Loads (other than Earthquake), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To identify the different types of Steel sections available in the market.
2. To design of Connections and Different types of members which are subjected to various loads.
3. To do the plastic analysis and estimate its effects.
4. To design the PEB and Gantry girders.
5. To understand the cold form gauge sections and its applications.

	Mapping of COs with POs												**Mapping with PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			3			2				1				2		1
CO2		3	3			2				1			2	3		1
CO3			3							1				1		1
CO4	2		3	2		2				1			1	2	1	1
CO5		3	2			2		1					2	3		1

CZPE604	STRUCTURAL CONCRETE DESIGN III	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students to expose with the design practices of elevated water tanks, deep beams, grid floors, flat slabs, concrete walls.
- To understand the force flow at the joints and design of joints.

UNIT I Water Tanks

Design of Elevated square, rectangular and circular shape water tanks with staging – Design includes cover slab; side wall, base slab, columns with staging as per IS 11992: 1995, Reinforcement detailing as per SP 34: 1987.

UNIT II Corbels and Deep Beams

Design of concrete Corbels for crane loads, Design of Deep beams using Strut and tie concept - Reinforcement detailing as per SP 34: 1987.

UNIT III Grid Floors

Design of Ribbed (Voided Slabs), Design of Grid floors - Reinforcement detailing as per SP 34: 1987.

UNIT IV Flat Slabs

Design of Flat Slabs using Direct Design Method - Equivalent Frame Method - Reinforcement detailing as per SP 34: 1987.

UNIT V Shear Wall and B-C Joints

Design of Concrete Shear Walls - Design of concrete joints - Interior and exterior column beam joints - Reinforcement detailing as per SP 34: 1987.

TEXT BOOKS

1. Krishnaraju.N, "*Advanced R.C. Design"*, CBS Publishers & Distributors Pvt Ltd, New Delhi, 2012.
2. Punmia.B.C, et al, "*R.C. Structures- Vol.I & II",* Laxmi Publications (P) Ltd., Chennai, 1995.

REFERENCES

1. Mallick.S.K&Gupta.A.P, "*Reinforced Concrete"*, Oxford & IBH Publishing, New Delhi, 1987.
2. Park and Paulay. T, "*R.C. Structures"*, Tata McGraw Hill Publications, New Delhi, 1975.
3. Ramamrutham.S and Narayan. R, "*Design of R.C. Structures",* Dhanpat Rai and Sons, Delhi, 1992.
4. Dayaratnam P, "*Design of RC Structures"*, OXFORD & IBH Publishing, New Delhi, 2000.
5. Punmia.B.C, "*R.C. Structures– Vol. II"*, Standard Publishers, New Delhi, 1991.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force, Bureau of Indian Standards, New Delhi.
3. SP 34: 1987, Handbook on Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4. IS 3370 (Part IV): 1967, Code Of Practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi
5. IS 11992: 1995, Criteria for Design of RCC Staging for Overhead Water Tanks, Bureau of Indian Standards, Codal recommendations.

COURSE OUTCOMES

At the completion of the course students will be able

1. To design the special structural elements as per relevant IS standards.
2. To design the grid floor and flat slabs as per codal recommendations.
3. To design the corbels and deep beams
4. To understand the concept of force flow at the joints and design of joints
5. To design the shear walls and its benefits

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3			2		3		1		1	3	3		2
CO2	3	3	3			2		3		1		1	3	3		2
CO3	3	3	3			2		3		1		1	3	3		2
CO4	3	3	3			2		3		1		1	3	3		2
CO5	3	3	3			2		3		1		1	3	3		2

CZPE605	TRANSPORTATION ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To impart knowledge on the layout, operations and design of Highways, Railways, Waterways and Airways transportation systems

UNIT I

Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

UNIT II

Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems

UNIT III

Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

UNIT IV

Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems

UNIT V

Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

TEXT BOOKS

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, *'Highway Engineering',* Revised Tenth Edition, Nem Chand & Bros, 2017.
2. Kadiyalai, L.R., *"Traffic Engineering and Transport Plannin"',* Khanna Publishers.

REFERENCES

1. Partha Chakraborty, *" Principles Of Transportation Engineering",* PHI Learning,
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, *"Principles of Highway*
3. *Engineering and Traffic Analysis"',* Fourth Edition, John Wiley publisher.
4. Srinivasa Kumar, R, "*Textbook of Highway Engineering",* Universities Press, 2011.
5. Paul H. Wright and Karen K. Dixon, *"Highway Engineering",* Seventh Edition, Wiley Student Edition, 2009.

COURSE OUTCOMES

On completion of the course, the students will be able to:

1. Carry out surveys involved in planning and highway alignment
2. Design the geometric elements of highways and expressways
3. Carry out traffic studies and implement traffic regulation and control measures and intersection design
4. Characterize pavement materials and
5. Design flexible and rigid pavements as per IRC

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3		2					3				2	2	1	
CO2			3			2								2		
CO3		3	3		2				2				1	3	1	
CO4			3			1	2		1					3		
CO5																

CZPE703	PRESTRESSED CONCRETE	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To inculcate the basics of pre-stressing techniques to understand the design concepts used for design of bridge structures.

UNIT I

Prestress basic concepts – Advantages – Tendons, strands, concrete, end anchorages – Systems and methods of pre-stressing- Analysis of sections – Stress concept – Strength concept – Load balancing concept - Effect of loading on the tensile stresses in tendons – Losses of Prestress - Total losses for pre and post tensioning systems**.**

UNIT II

Flexural strength – Simplified procedures as per codes – Strain compatibility method – Basic concepts in selection of cross section for bending - Design of sections as per code for pre-tensioned and post-tensioned rectangular beams – Check for strength limit based on IS:1343-2012 – Design for shear based on IS:1343-2012. Design of anchorage zone reinforcement (end block)

UNIT III

Composite Sections – Types – Advantages - Analysis of stresses for composite sections – Analysis and Design – Flexural and shear strength of composite members – Shear key.

UNIT IV

Factors influencing deflections – Effect of tendon profile on deflections –Calculation of deflections –Short term deflections of un-cracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection and crack width.

Continuous beams**-**Method of achieving continuity-Analysis-Concordant cable and linear transformation

UNIT V

Design of concrete pipes - Circular tanks - poles - Rail way sleepers – Partial Prestressing – Applications.

TEXT BOOKS

1. Krishna Raju N, "*Prestressed concrete"*, Fifth Edition, Tata McGraw Hill Company, New Delhi, 2012.
2. Pandit.G.S. and Gupta.S.P., "*Prestressed Concrete"*, CBS Publishers and Distributers Pvt. Ltd, New Delhi, 2012.

REFERENCES

1. Rajagopalan.N, "*Pre-stressed Concrete"*, Narosa Publishing House, New Delhi, 2002.
2. Dayaratnam.P., "*Pre-stressed Concrete Structures"*, Oxford and IBH, New Delhi, 2013.
3. Lin T.Y. and Ned.H.Burns, *"Design of prestressed Concrete Structures",* Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. IS1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
5. IS 3370-1:2009 Concrete structures for storage of Liquids. Bureau of Indian Standards, New Delhi, 2012.

COURSE OUTCOMES

At the completion of the course students will be able to

1. Gain knowledge on methods of pre-stressing.
2. Design various Pre-stressed concrete structural elements.
3. Understand the deflection criteria and its Codal recommendations.
4. Understand the concepts of composite section and its analysis.
5. Design the cables and tendons profile for prestressing and also to design the concrete pipes, circular tanks, railway sleepers, etc.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					2	2	1	1			1	2	1		1
CO2	3	2	2	2	2	1	1	1		1		1	3	3	2	2
CO3	3	2	2	2	1	1	1	1		1		1	3	3	2	2
CO4	2	2		1		1	2	1					3	2	1	1
CO5	3	2	2		2		1	1				1	3	3	1	1

CZPE704	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students conversant with basic principles of water supply engineering.
- To know quantification of water, analysis, sources, conveyance, treatment and distribution of water.

UNIT I Water

Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment*:* aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes

UNIT II Sewage

Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

UNIT III Air

Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations. *Noise*- Basic concept, measurement and various control methods.

UNIT IV Solid Waste Management

Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

UNIT V Building Plumbing

Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used. Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution.

TEXT BOOKS

1. Gilbert Masters, *"Introduction to Environmental Engineering and Science",* Prentice Hall, New Jersey.
2. P.Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; *"Introduction to Environmental Engineering*", Second Edition., 2008.

REFERENCES

1. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. "*Environmental Engineering"*, Mc-Graw –Hill International Editions, New York, 1985.
2. MetCalf and Eddy. "*Wastewater Engineering, Treatment, Disposal and Reuse"*, Tata McGraw- Hill, New Delhi.
3. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
4. S.M. Patil, "*Plumbing Engineering. Theory, Design and Practice",* 1999. Tchobanoglous, Theissen & Vigil, *"Integrated Solid Waste Management",* McGraw Hill Publication.
5. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

COURSE OUTCOMES

After successfully studying this course, students will:

1. Understand the impact of humans on environment and environment on humans
2. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
3. Be able to plan strategies to control, reduce and monitor pollution.
4. Be able to select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
5. Be conversant with basic environmental legislation.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2					2	2						2	2		
CO2	2					3	3						2	3		
CO3	2					3	3						2	3		
CO4	2			2									2			
CO5	2					1	2						2	1		

CZPESCN	STRUCTURAL CONCRETE DESIGN IV	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concepts of designing bridges deck slab, concrete Pipes, bunkers and silos and chimneys with relevant codal standards.

UNIT I

IRC loadings standards, Bridge deck slab design using Pigeaud's curves – Design of Solid slab bridges as per IRC: 6-2014 and IRC 21: 2000 - Reinforcement detailing as per SP: 34-1987.

UNIT II

Machine Foundations - Types - General Requirements - Design Parameters - Design Criteria and Codal Provisions for Reciprocating and Rotary Type Machines as per IS 2974 (Part I to IV).

UNIT III

Design of prestressed bridges for Buried Concrete Pipes to Carry Water and Gas as perrelevant codes – Design of Post tensioned Concrete slabs - Design of Post tensioned Concrete T section Girders as per IS 1343:2012.

UNIT IV

Design of Concrete Bunkers and Silos as per IS 4995 (Part I, II): 1974, IS 5503 (Part I):1969 – Reinforcement Detailing as per SP:34 -1987.

UNIT V

Design of concrete Chimneys as per IS 4998(Part I):1992 - Stresses in chimneys - Reinforcement detailing as per relevant codes.

TEXT BOOKS

1. Krishnaraju.N, *Advanced R.C. Design*, CBS Publishers & Distributors Pvt. Ltd, New Delhi, 2012.
2. Punmia.B.C, et al, *R.C. Structures- Vol.I& II,* Laxmi Publications (P) Ltd. Chennai, 1995.

REFERENCES

1. Ramamrutham.Sand Narayan.R, *Design of R.C. Structures,* Dhanpat Rai and Sons, Delhi, 1992.
2. Dayaratnam P, *Design of RC Structures*, OXFORD & IBH Publishing, New Delhi, 2000.
3. Mallick.S.K&Gupta.A.P, *Reinforced Concrete*, Oxford I B H, New Delhi, 1987.
4. Park and Paulay. T, *R.C. Structures*, Tata McGraw Hill Publications, New Delhi, 1975.
5. Punmia.B.C, *R.C. Structures– Vol. II*, Standard Publishers, New Delhi, 1991.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
3. SP 34: 1987, Handbook on Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi
4. IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II (Loads And Stresses), *Indian Roads Congress* , New Delhi.
5. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III [Cement Concrete (Plain And Reinforced)], *Indian Roads Congress* , New Delhi
6. IS 1343:2012, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
7. IS 2974 (Part I) :1982, Code of Practice for Design and Construction of Machine Foundations (Foundation for Reciprocating Type Machines), Bureau of Indian Standards, New Delhi
8. IS 2974 (Part II) :1980, Code of Practice for Design and Construction of Machine Foundations [Foundations For Impact Type Machines (Hammer Foundations)], Bureau of Indian Standards, New Delhi
9. IS 2974 (Part 3) : 1992, Design and Construction of Machine Foundations - Code of Practice [Foundations for Rotary Type Machines (Medium and High Frequency)], Bureau of Indian Standards, New Delhi
10. IS 2974 (Part IV) :1979, Code of Practice for Design and Construction of Machine Foundations (Foundations for Rotary Type Machines of Low Frequency), Bureau of Indian Standards, New Delhi
11. IS 4995 (Part I): 1974, Criteria for Design of Reinforced Concrete Bins for the Storage of Granular and Powdery Materials (General Requirements and Assessment of Bin Loads), Bureau of Indian Standards, New Delhi
12. IS 4995 (Part II) :1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular and Powdery Materials (Design Criteria), Bureau of Indian Standards, New Delhi
13. IS 9178 (Part II) :1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria), Bureau of Indian Standards, New Delhi
14. IS 5503 (Part I) :1969, General Requirements for Silos for grain storage (Construction requirements), Bureau of Indian Standards, New Delhi
15. IS 4998 (Part I): 1992, Criteria for Design of Reinforced (Assessment of Loads), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the end of the course students will be able

1. To design the bridges deck slab as per Indian Standards.
2. To design concrete Pipes as per the codal provisions.
3. To design bunkers, silos and chimneys with relevant IS standards.
4. To provide the detailing of reinforcements as per Codal recommendations.
5. To design the machine foundation and its detailing.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2		2						1	3	3	1	
CO2	3	2	2	2		2						1	3	3	1	
CO3	3	2	2	2		2						1	3	3	1	
CO4	3	2	2	2		2						1	3	3	1	
CO5	3	2	2	2		2						1	3	3	1	

CZPESN	ADVANCES IN CONCRETE TECHNOLOGY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To develop furtherance of knowledge about advances in concrete technology.
- To introduce concept of mix design for special concretes.
- To develop the principles of special concreting techniques and non destructive testing procedures for concrete structures.

UNIT I

Admixtures – Chemical – Mineral – SCMs and CRMs - Pozzolanic classification in concrete – use of fly ash, GGBS, silica fume, metakaolin in concrete –Concept of mix design for HPC, HSC, SCC – special concrete –Types – Classification – Properties – Applications – Pumped concrete – RMC

UNIT II

Definition - Fibre reinforced concrete – Properties of fibres and matrices – Mix proportioning– Properties of fresh and hardened fibre reinforced concrete – Durability – applications– SIFCON – SIMCON – Properties – Applications – Composite manufacturing.

UNIT III

Ferro-cement – Historical development – Constituent materials – Construction procedures – mechanical and durability properties – Design of Ferro-cement product – Applications.

UNIT IV

Special concrete: Light weight concrete – No fine concrete – High density concrete– polymer concrete composite – Classification – Application –Grouts and Grouting – Gunitingand shortcreting – Geopolymer concrete – Properties –Application – Special concreting techniques – Hot weather concreting – Cold weather concreting – Slipform.

UNIT V

Scanning Electron Microscopy (SEM) and X-ray microanalysis to examine cement, mortar concrete - Techniques of SEM and X-ray microanalysis- Simple imaging of fracture surfaces -Advanced techniques using X-ray microanalysis and digital image analysis on polished sections. X-ray spectra of cement clinker minerals and cement hydration products. Identify deleterious process in concrete, including alkali-silica reaction and sulphate attack-Interpretation of example images and X-ray spectra of the principal causes of damage to concrete.

TEXT BOOKS

1. Mehta P.K., and Monteiro, P.J.M., Concrete, Microstructure, Properties and Materials, Indian Concrete Institute, Chennai, 2013.
2. Shetty M.S., *Concrete Technology*, S.Chand&Co. New Delhi, 2007.

REFERENCES

1. Neville A.M., *Properties of concrete*, Marshfield, Mass, Pitman Publishing Limited London,1981.
2. Johnnewman and Ban Seng Choo, *Advanced concrete Technology,* (Vol.I to VI) Elsevier, London, 2003.
3. Gambhir. M.L,*Concrete Technology*, Tata McGraw-Hill Education (India) Private limited. New Delhi, 2009.
4. Santhakumar.A.R, *Concrete Technology*, Oxford University Press, New Delhi, 2007.

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand about various types of special concretes and testing techniques.
2. To understand the principles of special concreting techniques and non destructive testing procedures for concrete structures.
3. To prepare and recommending special concrete using admixtures.
4. To understand the behaviour of microstructure of concrete.
5. To understand the concepts of SEM analysis and X-ray micro analysis.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2		2	1					1	3	3	1	
CO2	3	2	2	2		2	1						3	3	1	
CO3	3	2	2	2		2	1					1	3	3	1	
CO4	3	2	2	2		2	1						3	3	1	
CO5	3	2	2	2		2	1						3	3	1	

CZPESCN	DESIGN OF LOAD BEARING MASONRY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- Masonry structures need not always be less strong in comparison to structures constructed with other materials.
- If proper principles of analysis and design are scientifically adopted and innovative approach is followed, masonry structures can be as strong and functional as other structures.
- This course deals with the scientific approach to be followed in the design of masonry structures.

UNIT I

Historical development – Classification of masonry construction – Codes and standards – Types of masonry walls – Bricks, Mortar, Grout and Steel reinforcement – Characteristics and Requirements – Loads types and intensities – Basic design data.

UNIT II

Basis of reinforced masonry design – Resistance to axial load, bending, shear – Design of reinforced masonry walls, masonry beams, masonry columns and masonry retaining walls – Detailing of reinforced masonry.

UNIT III

Basis of prestressed masonry design – Basic principles – Design strength –Vertical and Horizontal shear stress – Principal tensile stress – Design of cavity walls, Fin walls, Diaphragm retaining walls and Post – tensioned beams – Detailing of prestressed masonry.

UNIT IV

Connections and joints – Connection resistance – Design considerations – Connection details – Types – Seismic separations – Control joints – Expansion joints.

UNIT V

High-rise masonry – Design factors – Reinforcing details – Floor systems – Construction techniques.

TEXT BOOKS

1. RobertSchneider, R., and Walter DickeyL., "*Reinforced Masonry Design*", Englewood Cliffs, N.J.: Prentice Hall, USA, 1980.
2. Curtin, W.G., ShawG., and Beck J.K., Design of Reinforced and Prestressed Masonry, Thomas Telford, London, 1988.

REFERENCES

1. Hendry, A.W., SinhaB.P., and DaviesS.R.,"*An Introduction to Load Bearing Brickwork Design*",Chichester, E.Horwood, Halsted Press*,* Sydney, 1981.
2. David Lenczher, "Elements of Load Bearing Brick Work Design", Pergamon Press, London, 1972
3. Dayaratnam, P., "*Brick and Reinforced Brick Structures*"*,* Primlani M,for Oxford & IBH Distributed by South Asia Books, New Delhi, 1987.

COURSE OUTCOMES

At the end of the course students will be able

1. To understand the scientific approach to be followed in the design of masonry structures.
2. To analyse the application masonry materials and design related to civil engineering problems.
3. To know the testing of masonry structures.
4. To know where and how to construct the expansion joints in brick masonry structures.
5. To design the prestressed brick masonry structures.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					1							2	1		
CO2	3					1							2	1		
CO3	3					1							2	1		
CO4	3					1	1						2	1		
CO5	3	1	2	1		1	1					1	2	2	1	

CZPESCN	SCAFFOLDING AND FORMWORK DESIGN IN CONSTRUCTION	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To study and understand the overall and detailed planning of formwork, plant and site equipment.
- To understand the Design and erection of forms for various elements such as slabs, beams, columns, walls, shells and tunnels.
- To know the latest methods of form construction.

UNIT I

Definition – Economy of formwork and scaffolding – Care of formwork material – Type of form work materials - Allowable stresses in formwork materials – Factors affecting selection of scaffolding and formwork systems – Equipments -.General objectives of formwork building - Planning for safety - Planning for maximum reuse- Scaffold frames.

UNIT II

Qualities of formwork and scaffolding – Types of formwork – Types of scaffolding: Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds - Stages in formwork and scaffold – Formwork and Scaffold details for different structural members - Maintenance and Cost of formwork, scaffolding– Advantages of formwork and scaffold – Loads on formwork and scaffolds - Forms for foundations, columns, beams walls etc - Formwork hours- Formwork accessories - Formwork elements.

UNIT III

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Slenderness ratio - Allowable load vs. length behaviour in forms - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Allowable withdrawal load and lateral load -. Various causes of failures - ACI – Design and deficiencies.

UNIT IV

Pressure of concrete on formwork and scaffolding – Lateral pressure of concrete on formwork and scaffolding – Failures of formwork and scaffolding in different structural members- Pressures on formwork - Examples - Vertical loads for design of slab forms - Laterals loads on slabs and walls.

UNIT V

Hemispherical, Parabolic, Translational shells - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction – Shafts - Slip Forms - Principles -Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique.

TEXT BOOKS

1. Robert. Peurifoy and garold D. Oberlender *Form work for concrete structures;* McGraw -Hill , New Delhi, 1996.
2. *Safety requirements for scaffolding,* American National standards Institute; Broadway; New York.

REFERENCES

1. Awad S. Hanna ; *Concrete formwork systems* ; Prentice Hall Inc., New Jersy USA 2003.
2. Stewart champion ; *Access scaffolding* ; Iliffe, London, 2007.
3. Austin, C.K., *Formwork for Concrete*, Cleaver -Hume Press Ltd., London, 1996.

COURSE OUTCOMES

At the end of the course students will be able

1. To know the detailed planning of framework, design of forms and erection of form work.
2. To select the timbers and wooden planks with quality.
3. To have an idea of scaffolding fabrication for different works.
4. To check the formworks and scaffolding works and to check the stability before concreting.
5. To design the formwork and scaffolding works for different shapes to make paraboloid, shell and cylindrical structures.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2				1				1			3	1		1
CO2	3					1	1						2	1		
CO3	3					1				1			2	1		1
CO4	3					1	1						2	1		
CO5	3	1	1	1		1							2	1	1	

CZPESCN	TALL BUILDINGS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concept of different structural systems used for tall structures.
- To understand the types and principles of analysis and design of tall structures.

UNIT I

General – Factors affecting growth, height and Structural systems – Design philosophy – Loads: Gravity and lateral (Wind and Earthquake) – Load combinations – Strength and serviceability criteria – Stability and Drift limitations – Human comfort criteria – Creep, temperature, Fire and Foundation settlement effects – Effects of Soil Structure interaction.

Structural and non-structural systems – Structural system idealisations - Floor slab systems (wall supported slab system, Beam supported slab system, Ribbed slab system, Flat slab system). Vertical framing system (Columns, concrete walls, transfer girders, Suspenders) – Composite floor systems

Modelling for gravity and lateral loads – Assumptions – Modelling for approximate analyses – Modelling for accurate analysis.

UNIT II

Lateral load resisting systems – Behaviour of Rigid frames, Behaviour of Braced Rigid frames, Behaviour of shear wall with Rigid frames, Behaviour of framed-tubes, Behaviour of tube in tube, Behaviour of bundled tubes – Behaviour of In-filled frame structures

UNIT III

Analysis and design concepts of Rigid frames, Rigid frames with bracings, Rigid frames with shear walls, framed-tubes, tube in tube and bundled tubes.

UNIT IV

Stability of tall buildings – Overall buckling analysis of frames (Rigid frames, Rigid frames with bracings, Rigid frames with shear walls, framed-tubes, tube in tube and bundled tubes) using approximate methods –– Second order effects– Torsional instability – Effects of foundation settlements – Pounding effects – Temperature effects.

UNIT V

Importance of dynamic analysis as per IS 875(Part 3) and IS 1893(Part 1): 2002 – Methods of analyses as per code –How to minimise dynamic effect – Response to along and across wind effects as per SP:64-2001 - Response to earthquake motions – Response to ground accelerations – Response spectrum analysis –Estimation of natural frequencies and damping.

TEXT BOOKS

1. Bryan Stafford Smith, Alexcoull, Tall Building Structures, analysis and Design, John Wiley and Sons, Inc., New Delhi, 1991.
2. Taranath B.S., *Structural Analysis and Design of Tall Buildings*, McGraw Hill, New Delhi, 2011.

REFERENCES

1. Lin.T.Y,StotesBurry.D, Structural Concepts and systems for Architects and *Engineers*, JohnWiley, Inc.,Navi Mumbai,1988.
2. Lynn S.Beedle, *Advances in Tall Buildings*, CBS Publishers and Distributors, Delhi, 1986.
3. Wolfgang Schueller, *High Rise Building Structures*, John Wiley and Sons, New York, 1977.

STANDARDS

1. IS 875 (Part 3): 1987 Design loads – Wind load for Buildings and Structures, Bureau of Indian Standards, New Delhi
2. IS 1893 (Part 1): 2002, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi
3. SP:64 (S&T)-2001 Design Loads (other than earthquake) for Buildings and Structures, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able to

1. Gain the knowledge about the behaviour of tall buildings subjected to lateral loads and their stability.
2. Design the tall buildings as per the existing codes.
3. Check the stability of the structures under the present and expected loading conditions.
4. Do the dynamic analysis of a structure to withstand the present and expected loadings.
5. Estimate the natural frequencies and damping of a structure.

	Mapping of COs with POs												**Mapping with PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2		2		2							3	3	1	
CO2	3	2	2			2							3	3		
CO3	3	2	2		1	2							3	3	1	
CO4	3	2	2	1	1	2	1						3	3	1	
CO5	3	2			1	2							3	2	1	

OPEN ELECTIVES

CZOE606	FOUNDATION ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To impart basic knowledge on design of foundations and its behaviours under different soil conditions to carry out proper foundation design.

UNIT I

Field Soil Exploration – Soil exploration techniques – Equipments of soil exploration - Auguring and boring – Wash boring and rotary drilling – Depth of boring – Spacing of bore hole – method of collection of disturbed and un-disturbed soil samples - Split spoon sampler, Thin wall sampler, Stationery piston sampler – Field tests-Penetration tests (SPT and SCPT) – Bore log report – Data interpretation – Strength parameters and Liquefaction potential – Selection of foundation based on soil condition – Discussion on sample Soil investigation report.

UNIT II

Necessity for shallow foundations – Relevant IS code standards–Bearing capacity of shallow foundation on homogeneous deposits- Terzaghi's formula and IS code formula – Factors affecting bearing capacity. Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Effect of water table- Allowable bearing pressure – Safe bearing capacity – Seismic considerations in bearing capacity evaluation. Problems to assess bearing capacity

Settlement of foundations – Immediate, consolidation and secondary(creep) Settlements – Elastic Settlement of footings – Correction for depth and width of foundation - Determination of total Settlement of foundations on cohesion-less and cohesive soils as per relevant IS standards – Total and differential settlements – Allowable settlements as per relevant IS standards – Methods of minimizing total and differential settlements.

UNIT III

Contact pressure distribution on base of footings under rigid and flexible footings - Modulus of sub-grade reaction on rigid and flexible footings – Problems on contact pressure distributions beneath the isolated, combined ,strap and mat foundations for axial and eccentric column loads. Draw shear force and bending moment diagrams using appropriate contact pressures beneath the foundations.

UNIT IV

Types of piles and their function – Factors influencing the selection of pile – Ground heave and pile heave effects- Effective length –Point of inflection - Load carrying capacity of single pile in cohesion-less or granular and cohesive soils as per relevant IS standards– static formula – Dynamic formulae (Engineering news and Hiley's) – Capacity from in-situ tests (SPT and SCPT) – Negative skin friction – Uplift capacity- Group capacity by different

methods – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

UNIT V

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesion less and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations with and without surcharge and traffic loads – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls.

TEXT BOOKS

1. Moothy V.N.S., "*Soil Mechanics and Foundation Engineering"*, CBS Publishers and Distributers Ltd., New Delhi, 2007.
2. Gopal Ranjan and Rao A.S.R., "*Basic and Applied soil mechanics"*, New Age International Pvt. Ltd, New Delhi, 2005.

REFERENCES

1. Das B.M. "*Principles of Foundation Engineering",* Fifth Edition, Thompson Asia Pvt. Ltd., Singapore, 2003.
2. Kaniraj S.R., "*Design aids in Soil Mechanics and Foundation Engineering"*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
3. Punmia B.C. "*Soil Mechanics and Foundations"*, Laxmi Publications Pvt.Ltd., New Delhi, 2005.
4. Venkatramaiah C. "*Geotechnical Engineering"*, New Age International Publishers, New Delhi, 2007 (Reprint).
5. Arora K.R, "*Soil Mechanics and Foundation Engineering"*, Standard Publishers and Distributors, New Delhi, 2005.
6. Purushothama Raj. P*., "Soil Mechanics and Foundation Engineering"*, Second Edition, Pearson Education, Delhi, 2013.
7. Varghese, P.C., "*Foundation Engineering"*, Prentice Hall of India Private Limited, New Delhi, 2005.

STANDARDS

1. IS 6403: 1981 (Reaffirmed 1997), Bearing capacity of shallow foundation, Bureau of Indian Standards, New Delhi.
2. IS 8009 (Part1):1976 (Reaffirmed 1998), Shallow foundations subjected to symmetrical static vertical loads, Bureau of Indian Standards, New Delhi.
3. IS 8009 (Part2):1980 (Reaffirmed 1995), Deep foundations subjected to symmetrical Static vertical loading, Bureau of Indian Standards, New Delhi, 1992
4. IS 2911(Part1):1979 (Reaffirmed 1997), Concrete Piles, Bureau of Indian Standards, New Delhi.
5. IS 2911(Part2):1979 (Reaffirmed 1997), Timber Piles, Bureau of Indian Standards, New Delhi.
6. IS 2911(Part 3):1979 (Reaffirmed 1997), Under Reamed Piles, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part 4):1979 (Reaffirmed 1997), Load Test on Piles, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To select type of foundation required for the soil at a place and able to design shallow, foundation, deep foundation and retaining structures.
2. To calculate the safe bearing capacity of soils.
3. To advise the type of foundation suitable for the particular soil type.
4. To know the tests required to conduct for the soil type and how to carry out those tests.
5. Calculate the properties of soils and to estimate the optimum levels for recommending the foundation sizes.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1				3		1								2	2	
CO2		2	2	2									1	2	1	
CO3		3	3	3	2								2	2	2	
CO4		2	3	2	2								1	2	2	
CO5		2	2	3	2	1							1	2	2	

CZOE705	FINITE ELEMENT METHOD	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To learn the analysis of structures with a versatile technique finite element methods which can accommodate variations in material and engineering properties and can tackle multilayered systems and non linearity with ease.

UNIT I

Introduction - Finite Element Formulation – Steps involved - Advantages and Disadvantages - Applications - Two Dimensional Elasticity problems - Plane Stress and Plane Strain - Equilibrium equations -Strain-displacement equations - Compatibility equations - Constitutive equations - Boundary conditions.

UNIT II

Finite Element types – Displacement Function - Natural Coordinates – Shape Functions – Shape functions for truss elements in local and global coordinates - Shape function for beam and frame elements, Triangular elements (CST and LST elements), Rectilinear Iso-parametric elements, Solid elements.

UNIT III

Element stiffness formulation for truss elements in local and global coordinates, beams, CST elements, Load vectors for gravity, surface and body forces.

UNIT IV

Numerical Integration for evaluation of element stiffness – Load vectors- Computation of stresses. Use of Static Condensation Techniques, Axi-symmetric elements, Sub-structuring, Plate bending and shell elements.

UNIT V

Pre and Post Processing – Modelling techniques – Complete algorithms with flow chart for solving FEM problems - Solution Techniques – Linear analysis-Non-linear analysis both material and geometric non-linearity Use of Finite element software packages such as ANSYS, SAP 2000N, STAAD Pro, ETABS, ABAQUS, MSC/NASTRAN, etc.

TEXT BOOKS

1. Seshu P, "*Finite Element Analysis",* Prentice Hall of India, New Delhi, 2005.
2. Chandrupatla, T.R. and Belegundu, A.D, "*Introduction to Finite Element in Engineering"*, Prentice Hall, Delhi, 2003.

REFERENCES

1. Krishnamoorthy.C.S, "*Finite Element Analysis - Theory and Programming",* Tata McGraw Hill Publications, New Delhi,1995.
2. Rajasekaran.S, "*Finite Element Analysis in Engineering Design",* S.Chand and Co., New Delhi, 2014.

3. Cook.R.D, "*Concepts and Applications of Finite Element Analysis",* Tata McGraw Hill Publications, New Delhi, 1989.
4. Desai.C.S & Abel.J.F, "*Introduction to the FEM",* Affiliated East West Press, New Delhi,1972.
5. Rao.S.S, "*The Finite Element Method in Engineering"*, Butters worth-Heinemann Publishing, Burlington, 2000.
6. Reddy J.N, "*An Introduction to Finite Element Method"*, International Edition, McGraw Hill, New Delhi, 2006.

COURSE OUTCOMES

At the completion of the course students attains

1. The knowledge of solving physical problems using finite element softwares.
2. To develop computer coding for any structural problem and creating software packages.
3. The knowledge in solving practical problems by global stiffness matrix approaches for truss, beam, etc.
4. The knowledge of modelling techniques of the problems.
5. The knowledge of using FEM softwares for the practical problems and to find the solution.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3		3	3								3	2	3	
CO2	3	3	3	3	3								3	3	3	
CO3	3	3	3	3	3								3	3	3	
CO4	3		2	2	3								3	2	3	
CO5	3	3	3	3	3								3	3	3	

CZOE801	EARTHQUAKE ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students to understand Earthquake and Wind excitations are two major dynamic loadings to be considered for many modern civil engineering structures.
- To understand the seismic loadings to ensure the safety and serviceability of structures.

UNIT I

Elements of Earth, core, mantle and crust- Engineering Seismology, Plate tectonic theory , originations of earthquake- Volcanic and tectonic origins, Faults, Dips, slips in crust, seismic zoning map of India & its use.

Earthquake Effects: Land and rock slides, Liquefaction, Fires, Tsunamis, Floods, Release of poisonous gases and Radiation.

Earthquake Phenomenon: - Focus epicentre, Seismic waves, Magnitude, intensity, Ritcher scale, MM scale, Earthquake recording instruments, and Seismic resistant design guidelines

UNIT II

Dynamics: Vibration, frequency, D'alembert's Principle, Dynamic equilibrium equation, inertial force, Damping force, Stiffness force, Mathematical models, and Discrete (lumped parameter) systems: SDOF, MDOF systems, Continuous systems, Formulations of equations of motions for two and three storey building. Free vibration analysis of SDOF systems with and without viscous damping, Experimental methods of assessing viscous damping present in the dynamic systems: logarithmic decrement method, Half power band width method, and simple problems.

UNIT III

Forced Vibration Analysis (Harmonic loading) of Single Degree of freedom systems with and without damping under harmonic excitations, Forced vibration response to harmonic base excitation. Formulation of Response Spectrum, Design Response spectrum as per IS:1893, simple problems using the above response spectrums. Forced vibration analysis of multi Degrees of freedom systems (restricted to two degrees of freedom only) using modal superposition technique.

UNIT IV

Analysis of building frames, Equivalent static method as per IS: 1893- Dynamic analysis using mode superposition concept- Push over analysis. Modelling of Building Frames with Brick and Concrete Walls- Centre of Mass locations- Centre of Stiffness locations- Orientation of Shear walls.

UNIT V

Philosophy and Principles of Earthquake Resistance design- Strength and Stiffness, Ductility Design and Detailing (IS 13920: 1993), Concept of Energy Absorbing Devices,

Concepts of Seismic Base isolation technique and Seismic Active control methods. Lessons learnt from the Past Earthquakes - Case studies of important Indian Earthquakes, Major world Earthquakes.

TEXTBOOKS

1. Dowrick, D.J., "*Earthquake Resistant Design,* John Wiley & Sons", Winchester, U.K., 1977.
2. Paulay, T. and Priestley, M.J.N., "*Seismic Design of Reinforced and Masonry Buildings",* John Wiley & Sons, Inc., New York, 1992.

REFERENCES

1. Anil k Chopra, "*Dynamics of Structures",* McGraw-Hill International Edition, New Delhi, 1998.
2. Clough, R.W. and Penzien, J., "*Dynamics of Structures",* Second Edition, McGraw-Hill International Edition, New Delhi, 1993.
3. Kiyoshi Muto, "*Earthquake Resistant Design of Tall Buildings in Japan",* University of California, 1973.
4. Beskos.D.E*, "Computer Analysis & Design of Earthquake Resistant Structures- A, Handbook Advances in Earthquake Engineering",* Computational Mechanics Inc, Billerica 1997.
5. Hiroshi Akiyama, "*Earthquake Resistant Limit State Design for Buildings"*,University of Tokyo Press, Tokyo, 1985.
6. Paz, M. and Leigh.W. "*Structural Dynamics – Theory & Computation"*, 4th Edition, CBS Publishers & Distributors, New Delhi, 2006.

STANDARDS

1. IS 1893:2002 Criteria for Earthquake Design of Structures, Bureau of Indian Standards, New Delhi.
2. IS 4236:1976 Code of Practice for Earthquake Resistant Design and Construction of Buildings, Bureau of Indian Standards, New Delhi.
3. IS 13920: 1993 Ductile Detailing of Reinforced Concrete Structures Subjected to
4. Seismic Forces Code of Practice, Bureau of Indian Standards, New Delhi.
5. SP: 22- 1982 Explanatory Handbook on Codes for Earthquake Engineering, Bureau of Indian Standards, New Delhi.
6. IS 1382: 1993 Guidelines for Improving Earthquake Resistance of Earthen Buildings
7. Bureau of Indian Standards, New Delhi.
8. S 13828: 1993 Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, Bureau of Indian Standards, New Delhi.
9. IS 13935: 1993 Guidelines for Repair and Seismic Strengthening of BuildingsBureau of Indian Standards, New Delhi.
10. SP:24 (S&T) - 1983 Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete (IS 456:2000), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To design the earthquake resistance structures.
2. To understand the behaviour of structure during earthquake.
3. To recommend the materials used for construction in the earthquake prone areas.
4. To analyze the building frames for dynamic loadings.
5. To provide the detailings of reinforcement for seismic analysis.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		3		3								2	1	1	
CO2	3				3	2	1						2	1	1	
CO3	3				2	3	2						2	1	1	
CO4	3	3		3	3								3	2	3	
CO5	3	3	3	3	3								3	3	3	

CZOE802	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

1. To understand the mechanism of deterioration of concrete, damage assessment, repair materials and rehabilitation techniques.

UNIT I

Introduction – Mechanics of deterioration of concrete – Physical Causes – Freeze and Thaw – Water evaporation – Crystallization of salts in pores – Permeation of water and gases – Chemical Causes – Hydrolysis & Leaching – Sulphate attack – Chloride attack – Salt attack.

UNIT II

Effect of Steel chemistry – Effect of Concrete microstructure – Effect of internal stress levels – Effect of steel bar design – Effect of imposed forces – Effect of environments – Corrosion process in RC structures – Corrosion protection techniques.

UNIT III

Investigations – Visual inspection – Inspection by records – Inspection with instruments: – Surface Hardness Methods – Penetration Techniques (Simbi Hammer, Spit Pins, Windsor Probe, PNR Tester) – Pull Out Tests (Lok Test, TNS Tester, Internal Fracture Test, Epoxy Grouted Bolt) – Core Drilling – Resonant Frequency Method – Ultrasonic Pulse Velocity Method – Pulse Attenuation Method – Pulse Echo Method – Radio Active Method – Nuclear Methods – Magnetic Methods – Electrical Methods – Acoustic Emission Technique – Insitu Permeability Test.

UNIT IV

Introduction - Repair materials – Guniting – Grouting – Cement Grouting – Epoxy Grouting – Polymer Grouting – Epoxy Coating – Epoxy Mortar Coating – Sand Blasting – Grinding – Stitching – Dry Pack – Prepacked Concrete – Resurfacing – Acid etching – Caulking.

UNIT V

Methodology for repair materials - Mortar Replacement – Concrete Replacement – Total Replacement – Preplaced aggregate concrete – Jacketing technique – Plate Bonding technique – Fibre Sheet Bonding Technique

TEXT BOOKS

1. Peter H. Emmons, *Concrete Repair and Maintenance*, Galgotia Publishers, New Delhi, 2002.
2. Vidivelli.B, *Rehabilitation of Concrete Structures*, Standard Publishers Distributors, New Delhi, 2007.

REFERENCES

1. Ted Kay, *Assessment and Renovation of Concrete Structures*, Longman Scientific & Technical, New York, 1992.
2. Allen, R.T.L. and S.C. Edwards, *The Repair of Concrete Structures*, Blackie & Son Ltd Glasgow, V.K, 1987.

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand about the mechanics of deterioration of concrete.
2. To estimate and analyze the degree of damage by testing methods.
3. To identify the repairs and suitable repair methods and materials.
4. To gain the knowledge about rehabilitation and retrofitting of structural members.
5. To understand the repair and strengthening of RC structures with reasonable cost.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	2	2	3	3	2	2	1	2	3	3	2	2
CO2	3	3	2	2	2	2	3	3	2	2	1	2	3	3	2	2
CO3	3	2	2	3	3	2	3	3	2	2	1	2	3	3	2	2
CO4	3	3	3	3	3	2	3	3	2	2	1	2	3	3	3	2
CO5	3	2	2	2	3	2	2	2	2	2	2	2	3	3	2	2

HONOURS ELECTIVES

CZHESCN	BEHAVIOUR OF REINFORCED CONCRETE STRUCTURES	L	T	P	C
		3	-	-	4

COURSE OBJECTIVES

- The objective of this course is to provide basic knowledge relating to the behaviour of concrete under flexure, shear and torsion in isolation and in combination.
- The serviceability issues are also included in the course.

UNIT I

Stress–Strain relationships for concrete and steel – Behaviour of concrete under uni-axial compression, Tension and Combined stresses. Behaviour of concrete under static and dynamic loads– Behaviour of concrete under sustained loading over a period of time (Creep) Behaviour of concrete under Shrinkage and temperature changes. Design philosophy– Working Stress Method – Ultimate Load Method – Limit State Method –Load resistance Factor Design Method.

UNIT II

Behaviour of Beams and slabs for flexure uncracked phase-cracked phase – stages leading to limit state of collapse – analysis at service loads- analysis at ultimate limit state – moment- versus curvature relationships. Behaviour of concrete in shear – mechanism of shear resistance of concrete due to aggregate interlock, dowel and with web reinforcement – critical sections for shear – relationship between tensile stress with shear stress– interaction of flexure, shear and axial forces.

UNIT III

Behaviour of concrete in torsion – equilibrium and compatibility torsion – combined flexure and torsion – combined shear and torsion – torsional stiffness– Torsion versus twist relationship for concrete members.

UNIT IV

Bond and anchorage – mechanisms of bond resistance – type of bond – bond failure mechanisms –anchorage requirements – splicing of reinforcement. Deflection and cracking – factors influencing deflection-short-term deflection – control of deflection–calculation of deflection-Long-Term deflection-Deflection due to temperature, creep and shrinkage– limits on deflection –causes of cracking-factors influencing crack width in flexure-mechanisms of flexural cracking- control of flexural cracking in design.

UNIT V

Detailing of reinforcements – Beams – Columns – beam- column connections –corbels – deep beams. Concrete cover-Fire Rating as per IS specification.

TEXT BOOKS

1. Robert Park & Thomas Paulay,*Reinforced Concrete Structures,* John Wiley & Sons, 1975
2. S.UnnikrishnaPillai and Devdas Menon, *Reinforced Concrete Design,* Tata McGraw Hill,1999.

REFERENCES

1. Branson, Dan.E., *Deformation of Concrete Structures,* McGraw Hill,1977.
2. Wang, C.K & Salmon, C.G, *Reinforced Concrete Design,* John Willey & Sons, 2002.
3. Edward G.Nawy, *Reinforced Concrete, A Fundamental Approach,* Prentice Hall, 1995.
4. Hiroyuki Aoyama, *Design of Modern High Rise RC Structures, World Scientific Publishing company,* 1st Edition, 2002.
5. George A. Hool*, Concrete Engineer's Handbook,* McGraw Hill, 1918.
6. Allan Williams, *Reinforced Concrete Structures, Kalplan AEC Education,* 3rdEdition, 2005.

CZHESCN	DYNAMICS OF STRUCTURES	L	T	P	C
		3	-	-	4

COURSE OBJECTIVES

- As modern structures are becoming more slender and light, they are also becoming more susceptible to dynamic loadings.
- Examples of real- life dynamic problems that frequently confront civil engineers include: aerodynamic stability of long-span bridges, earthquake response of multi-storey buildings, impact of moving vehicles on highway structures, *etc.,*
- The traditional engineering solutions to these problems, based on “static force” and “static response”, are no longer valid in most cases.
- Many of these problems have to be tackled by applying knowledge of structural dynamics.
- Thus, a basic understanding of the dynamic behaviour of structures as well as the underlying principles is essential for structural engineers

UNIT I Dynamics Systems

Mass, stiffness and damping elements, Degrees of Freedom, Discrete and continuous systems, Principles of Structural dynamics. Free, Forced, Un-damped, Damped, Linear, Non-linear, Deterministic and Random Vibrations. Vibration analysis: Harmonic analysis. Structural idealization with multi mass points. Identification of mass, stiffness and damping in a conventional structural systems. Classification of damping present in the dynamic systems with suitable examples.

UNIT II Discrete Systems

Analysis of Single Degree of freedom systems with damping without damping: Formulation of equation of motions using direction equilibrium concept and principle of conservation of energy. Equations of motion and solutions- logarithmic decrement – energy dissipation in viscous damping. Free vibration with coulomb damping, Free vibration with hysteretic damping.

UNIT III Discrete Systems

Forced vibration analysis of Single Degree of freedom systems with damping without damping under harmonic excitations: Formulation of equation of motions. Forced vibration with viscous damping – steady state solutions, constant force, harmonic exciting force of constant amplitude, harmonic exciting force with rotating mass type excitations, Harmonic response curves showing band-with and half power points – Natural frequencies and resonant frequencies. Analysis of forced vibration analysis using Impedance method. Forced vibration response to harmonic base excitation. Force Transmitted to base – Transmissibility in terms of displacement and force - simple problems on base isolation. Simple Vibration measuring instruments. Forced vibration with coulomb damping, Forced vibration with hysteretic damping. Self excited systems and stability.

UNIT IV Force vibrations

Force vibrations due to general periodic excitations. Response due to Non-periodic force- Convolution Integral method or Duhamel's Integral method - impulse response functions – Response to an arbitrary Excitation, step excitation, Impulse length ratio shock spectrum – Simple Problems. Free vibration analysis of multi Degrees of freedom systems: Formulation of equation of motions. Orthogonally of normal – Modal analysis – Un-damped system – Damped system using proportional damping – modes. Force vibration analysis of multi Degrees of freedom systems(restricted to three degrees of freedom only) – Formulation of equation of motions – Expressions in matrix form –solution of MDOF systems – Numerical methods for solution of MDOF systems.

UNIT V Continuous Systems

Vibrations of elastic beams and columns. Formulation of equations of motion. Vibration in elastic media. Kinematics of waves- longitudinal vibrations in a rod, impulse excitations of free bar. Finite element formulations for truss and beam elements using lumped parameter concept.

TEXT BOOKS

1. Anil k Chopra, *Dynamics of Structures,* McGraw-Hill International Edition, 1998.
2. Clough, R.W. and Penzien, J., *Dynamics of Structures, Second Edition,* McGraw-Hill International Edition, 1993.

REFERENCES

1. Kameswara Rao, *Vibration Analysis and Foundation Dynamics,* Wheeler Publishing, 1998.
2. Humar.L., *Dynamics of Structures, Second Edition,* McGraw-Hill International Edition, 1989.
3. Thomson and M.Dillon Dahleh, *Theory of Vibration with Application*, Prentice Hall, 5th Editon, 1997.
4. R.R.Craig, An *Introduction to Computer Methods – Structural Dynamics,* Wiley, 1981.
5. D.J.Inman, *Engineering Vibrations,* Prentice Hall, 2000

CZHESCN	BRIDGE ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- Bridge engineering is a specialized area in structural engineering practice. In this course, the students are taught the IRC loading standards and analysis and design of different types of bridges.

UNIT I

IRC Loading standards – Positioning of IRC loads for maximum moment and shear- Analysis of slabs using Pigeaud's curves- Design of Slab culverts as per IRC: 6-2014 and IRC 21: 2000.

UNIT II

Pipe culverts - General features - Classification - Analysis and design of Pipe Culvert. Box culverts – General features - Analysis and design of Box culverts as per IRC: 6-2014 and IRC 21: 2000.

UNIT III

Tee beam and slab bridges - General features – Pigeaud's curves – Courbon's theory – Design and detailing as per IRC: 6-2014 and IRC 21: 2000 - Balanced cantilever bridges - Bowstring girder bridges - Advantages - General features - Design principles only.

UNIT IV

Pre-stressed concrete bridges - Preliminary dimensions - Flexural and Torsional parameters – Design of girder section - Maximum and minimum pre-stressed forces - Eccentricity - Dead load and Live load moments and shears - Cable zone in girder - Check for stresses - Diaphragms - End block - Short-term and long-term deflections – Design and Detailing as per IS 1343:1980, IRC: 6-2014 and IRC 21: 2000.

UNIT V

Segmental bridges - Segmental bridge design, design for flexure Guidelines as per IRC 18-2000 and detailing as per SP-65:2005. Bridge bearings - Plate, Roller and Rocker bearings - Elastomeric bearings as per IRC: 83(Part I)-1999 and IRC 83(Part II)-1987).

TEXT BOOKS

1. Krishna Raju N, Design *of Bridges*, Oxford & IBH, New Delhi, 2010.
2. Ponnuswamy S, *Bridge Engineering,* Tata McGraw-Hill, New Delhi, 1986.

REFERENCES

1. Johnson Victor D, *Essentials of Bridge Engineering,* Oxford & IBH Pub. Co., New Delhi, 2001.
2. Rajagopalan N, *Bridge Super Structure*, Alpha Science International, London, 2006.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice
3. SP 34: 1987, Handbook on Concrete Reinforcement And Detailing.
4. IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II (Loads And Stresses).
5. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III[Cement Concrete (Plain And Reinforced)].
6. IS 1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
7. IRC: 83(Part I)-1999, Standard Specifications and Code of Practice for Road Bridges Section: IX, Part I (Metallic Bearings).
8. IRC: 83(Part I)-1999, Standard Specifications and Code of Practice for Road Bridges Section: IX, Part II (Elastromeric Bearings).

CZHESCN	COMPOSITES FOR CONSTRUCTION	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To develop an understanding of the behavior and design study of Steel concrete composite elements and structures.

UNIT I

Introduction to composite construction – Basic concepts – Types of composite materials - Application of composite construction in Civil Infrastructure – Durability – Physical and Mechanical properties of composite structures – Influence of moisture at consistent level in composite structure – Construction of composite structures.

UNIT II

Introduction – Fabrication Process – Quality Control during Manufacture – Testing Methodologies – Destructive and Non destructive testing - Mitigation Strategies – Materials and their properties – Stiffness properties – Strength properties – Manufacture of composite materials.

UNIT III

Introduction – Combustion of Polymer Composites – Fire reaction properties of Polymer Composites – Fire resistant Polymer Composites – Structural properties of Polymer Composites in Fire – Fire protection coatings – Predictive Modelling of Fatigue – Descriptive Modelling of Fatigue.

UNIT IV

Analysis of composite beams – Composite floor – Girders – Slabs - Composite column subjected to axial loads and moment – Shear connectors: functions and types – Maximum stress theory – Maximum strain theory – Stress strain relations - Analysis procedures of building for gravity and lateral loads - Study of IS: 11384 , IRC – 22 and their applications.

UNIT V

Introduction – Classes of joints – Bonded joints – Stress distribution – Modes of failure – Merits and demerits – Mechanical joints – Failure mode – Merits and demerits – Design of bonded and bolted joints – Bending failure – Tension failure – Multi bolt joints and its design.

TEXT BOOKS

1. Madhujitmukhopadhyay; *Mechanics of composite materials and structure,* Universities press, Telangana, 2004.
2. Jones, R.M., *Mechanics of composite materials*, McGraw Hill, Tokyo, 1998.

REFERENCES

1. Carlo Pelleqrino, Josesena, Cruz; Design procedure for the use of composites in strengthening of reinforced concrete structures , Springer , 2016.
2. Ravindra K. Dhir, kelvin a paine, moray d. Newlands, Composites materials in concrete construction, Ice publishing, 2012.
3. Vistasp M. Karbhari, Durability of composites for civil structure applications, woodhead publishing, 2012.
4. Lawrance C. Bank, Composite Construction, John Weiley sons & inc, USA, 2006

CZHESCN	DESIGN OF PLATES AND SHELLS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- This course provides a brief introduction to the analysis of folded plates and knowledge about the formation and classification of shell structures. Preliminary design is also included.

UNIT I

Introduction to plate structures - Thin and thick plates - Structural action of plates – Assumptions involved in plate theories - Differential equation for cylindrical bending of plates – Cylindrical bending of uniformly loaded rectangular plates with simply supported and built-in edges – Small deflection theory of laterally loaded rectangular plates - Kirchoffs boundary conditions - Corner effects

UNIT II

Simply supported rectangular plates under Sinu-soidal load - Navier solution - Levys method - Symmetrical bending of laterally loaded circular plates - Circular plates with simply supported and built-in edges - Bending of annular plates.

UNIT III

Introduction to shell structures - Classification of shells - Membrane action - Stressed shell element and stress resultants - Load transfer mechanism - Characteristics of shell surfaces - tructural behaviour of shells - Membrane theory of cylindrical shells

UNIT IV

Bending theory of circular cylindrical shells - Comparison of various bending theories - Introduction to other types of shells.

UNIT V

Necessary design inputs - Detailed design - Prismatic folded plates - Circular cylindrical barrel shell roofs - Spherical dome - Conical dome - HYPAR shell - Helicoids.

TEXT BOOKS

1. Ramaswamy G.S, Design & Construction of Concrete Shell Roofs, R.E. Krieger, Malabar, USA, 1984.
2. Stephen Timoshenko, S Woinowsky-Krieger, Theory of plates and shells, McGraw-Hill, New Delhi,2010.

REFERENCES

1. Mehdi Farshad, Design and Analysis of Shell Structures, Technology, Springer Science, Business Media, Dordrecht, 1992.
2. Rudolph Szilard, Theories and Applications of Plate Analysis, John Wiley, Chapman and Hall, Hoboken, NJ, 2004.
3. Binoy Kumar Chatterjee, Theory and Design of Concrete Shells, Chapman and Hall, London, 1988.
4. 64 Bairagi N.K, Shell Analysis, Khanna Publishers, Delhi, 1986.

CZHESCN	DISASTER RESISTANT DESIGN OF STRUCTURES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- This course aims in understanding the concept of designing structures to withstand disaster.

UNIT I

Earthquake resistant design of structures - Introduction about earthquakes -Site response to earthquakes -Structural form determination - Form of superstructure – Form of the substructure. Structural response to earthquakes: - Response of structural materials – Methods of seismic analysis – Review of the Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multi-storeyed building using Seismic Coefficient method.

UNIT II

Plan Configurations – Torsion Irregularities – Re-entrant corners – Nonparallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings.

Types – Design of Shear walls as per IS: 13920 – Detailing of reinforcements.

UNIT III

Cyclone-Resistant Design of Buildings as Per Indian Standards - Winds Damage Buildings- Catastrophic Failures- Component Failures- Damaging Effects of Cyclone on Houses- Design Wind Speed and Pressures- Design of the House-Design procedure for wind resistant buildings-Discussion of codal provisions IS 15498-2004 guidelines for improving the cyclonic resistance of low rise houses and other buildings/structures.

UNIT IV

Fire – Fire extinguishing methods- Classification of fire- cause of fire- safety measures- smoke- volume and quality of smoke- Types of fire extinguishers- Types of fire fighting system- Active and passive fire control design of buildings- General design requirements of building design in fire prevention- Review of the Indian standard code of practice for fire safety of buildings IS:1642 – 1989 provisions for buildings.

UNIT V

Blast resistant design of structures – Introduction – Blast force on structures – Response of structures to blast loading – Loads – Stresses – Planning for blast resistant buildings-Architectural and structural design for blast resistant buildings. Discussion of codal provisions IS 4991 -1968.

TEXT BOOKS

1. Jaikrishna & Chandrasekar, Elements of Earthquake Engineering.
2. Dowrick,D.J., Earthquake Resistant Designs, Wiley, 2nd Edition, New Delhi, 2009.

REFERENCES

- Buchholdt,H.A., *Structural Dynamics for Engineers*, Thomas Telford, London, 1997.
- Robert Englekirk E. and Gray HartC., *Earthquake Design of Concrete Masonry Buildings*, Englewood Cliffs, N.J, Prentice Hall, USA, 1982.
- AngusMacDonaldJ., *Wind Loading on Buildings*, Wiley, New Delhi, 1975.
- Alan Garnett Davenport, "Wind Loads on Structures", National Research Council, Canada.
- Schroll, R. C. (2002). *Industrial fire protection handbook.* (2nd ed.). CRC Press: Boca Raton, FL. ISBN: 1587160587
- Cote, A. & Bugbee, P. (1988). *Principles of fire protection*. National Fire Protection Association.
- Lawson, T.V., *Wind Effects on Buildings*, Applied Science Publishers, London, 1980.

MINOR ENGINEERING ELECTIVES

CZMISCN	CONSTRUCTION TECHNIQUES AND MANAGEMENT	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To know the fundamentals of the construction of structures from the beginning to the end
- To understand the construction projects planning and methods of execution, contracts and tendering, management methods and assessing the probability of completion
- To know the various construction techniques involved in the execution of construction.
- To know the availability of various equipments used for the construction and their related problems.
- To manage the various activities of construction, project monitoring and control over the contracts.

UNIT I Basics of Construction

Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution; Construction project planning- Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

UNIT II Construction Methods

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

UNIT III Construction Equipments

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities. Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing;

Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

UNIT IV Project Monitoring & Control

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost over runs and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

UNIT V Contracts Management

Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price). Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination, Changes & variations, Dispute Resolution methods - Construction Costs: Make-up of construction costs; Classification of costs, time-cost trade-off in construction projects, compression and decompression.

TEXT BOOKS

1. Varghese, P.C., "*Building Construction"*, Prentice Hall India, 2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi, 2017.

REFERENCES

1. Chudley, R., "*Construction Technology"*, ELBS Publishers, 2007.
2. Peurifoy, R.L. *"Construction Planning, Methods and Equipment",* McGraw Hill, 2011.
3. Nunnally, S.W., *"Construction Methods and Management",* Prentice Hall, 2006.
4. Jha, Kumar Neeraj., *"Construction Project management, Theory & Practice",* Pearson Education India, 2015.
5. Punmia, B.C., Khandelwal, K.K., *"Project Planning with PERT and CPM",* Laxmi Publications, 2016.

CZMISCN	SERVICES IN HIGH RISE BUILDINGS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- High rise buildings are a pleasure to watch, but they are made a pleasure to live in only when the functional requirements are adequately provided through proper ventilation, sanitation and water supply in addition to safety measures during calamities like fire.
- This course covers the principles and practices to be followed in the provision of good service systems.

UNIT I

Planning of building services - Important considerations - Floor loadings -Building cost – Material requirements.

UNIT II

Water supply services - Collection and examination of water samples - Standards - Internal storage and distribution - Bulk water supply - Water treatment - Selection of pumps - Pump rooms and sump.

UNIT III

Sanitation services - Sewerage collection and disposal - Storm water drains - Sewage disposal - Septic tanks - Solid waste disposal - Refuse disposal systems.

UNIT IV

Lift and Escalators - Types - Selection - Codes and Rules - Structural provisions – Strength considerations - Pits and overheads - Safety precautions.

UNIT V

Air-conditioning - Provisions in buildings - Systems. Acoustics - Noise in buildings - Noise control - Materials -Methods. Fire fighting services - Classification - Modes of fire - First- aid - Fighting installations – Fire extinguishers - Provisions in building from fire safety angle - Codes and rules.

TEXT BOOKS

1. Jain V.K, Designing and Installation of Services in Building. Complexes & High Rise Buildings, Khanna Publishers, Delhi, 2015.
2. Cyril M Harris**,** Handbook of Utilities and Services for Buildings: Planning, Design, and Installation, McGraw- Hill, New Delhi, 1990.

REFERENCES

1. Cady, W.G., *Piezoelectricity,* Dover Publications, New York, 1964.

CZMISCN	SMART MATERIALS AND SMART STRUCTURES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To know the different products of smart materials
- To know the purpose of Piezoelectric Ceramics, Piezo-polymers, Magnetostrictive Materials, Electro active Polymers, Shape Memory Alloys, Electro and Magneto Rheological Fluids, Modelling of smart materials.
- To study about the composite smart materials, Mechanics of smart composite materials, Smart sensors based on high bandwidth low strain smart materials, Low-bandwidth high strain smart actuators, Micro-electro mechanical Smart Systems and Intelligent devices based on smart materials
- To know the applications of Smart Actuators, Active and Hybrid Vibration Control, Active Shape Control, Distributed Sensing and Control of Smart Beams.

UNIT I

Introduction to Smart Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic Materials, Single Crystals vs. Polycrystalline Systems, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect, Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids.

UNIT II

Piezoelectric Strain Sensors, In-plane and Out-of Plane Sensing, Shear Sensing, Accelerometers, Effect of Electrode Pattern, Active Fibre Sensing, Magnetostrictive Sensing, Villari Effect, Matteuci Effect and Nagoka-Honda Effect, Magnetic Delay Line Sensing, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors.

UNIT III

Modelling Piezoelectric Actuators, Amplified Piezo Actuation – Internal and External Amplifications, Magnetostrictive Actuation, Joule Effect, Wiedemann Effect, Magnetovolume Effect, Magnetostrictive Mini Actuators, IPMC and Polymeric Actuators, Shape Memory Actuators, Active Vibration Control, Active Shape Control, Passive Vibration Control, Hybrid Vibration Control.

UNIT IV

Review of Composite Materials, Micro and Macro-mechanics, Modelling Laminated Composites based on Classical Laminated Plate Theory, Effect of Shear Deformation, Dynamics of Smart Composite Beam, Governing Equation of Motion, and Finite Element Modelling of Smart Composite Beams.

UNIT V

Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Autophagous Materials, Self- Healing Polymers, Intelligent System Design, Emergent System Design.

TEXT BOOKS

1. Brian Culshaw, *Smart Structures and Materials*, Artech House, London, 2000
2. Gauenzi, P, *Smart Structures*, Wiley, New Delhi, 2009

REFERENCES

1. Cady, W. G., *Piezoelectricity*, Dover Publication, New York, 1964

CZMISCN	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	-	-	4

COURSE OBJECTIVES

- This course teaches the advancement in the subsoil stabilization in a modern approach
- The real problem, methods of improvement over such problems and the methodology are dealt.

UNIT I

Introduction - Methods of ground improvement - Geotechnical problems in alluvial, lateritic and Black Cotton soils - Selection of suitable ground improvement methods based on soil conditions.

UNIT II

Drainage and dewatering - Drainage techniques - Vacuum and electro - Osmotic methods – Seepage analysis for 2D flow fully and partially penetrating slots in homogeneous deposits.

UNIT III

In-situ treatment of granular and cohesive soils – In-situ densification of granular soils - consolidation of cohesive soils - Dynamic compaction and consolidation –Vibro-floatation - Sand pile compaction - Preloading with sand drains and fabric drains - Stone columns - Lime piles- Relative merits of various methods and their limitations.

UNIT IV

Earth reinforcement - concept - Types of reinforcing materials - Application of reinforced earth – Geo-textiles in filtration drainage - Separation and road works.

UNIT V

Grouting techniques - Grouting equipments and machinery - Injection methods – Grout monitoring -Stabilization with cement, lime and chemicals - Stabilization of expansive soils.

TEXT BOOKS

1. Robert M Koerner, Construction and Geotechnical Methods in Foundation Engineering, McGraw-Hill, Inc, USA, 1984.
2. Mike Moseley, Klaus Kirsch, Ground Improvement, Taylor & Francis Ltd, Spon Press,London, 2003.

REFERENCES

1. Colin J F P Jones, *Earth Reinforcement and Soil Structures*, London; Boston: Butterworths, 1985.
2. Craig R F, *Soil Mechanics,* 7th Edition Taylor & Francis, London, 1992.

CZMISCN	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
		3	-	-	4

COURSE OBJECTIVES

- This course helps the students to understand the elastic and plastic behaviours of engineering materials and to evaluate stresses and strains developed in materials more exactly.

UNIT I

Basic equations - Stress and strain at a point - Generalized Hooke's law - Plane stress and plane strain - Equilibrium conditions - Compatibility conditions. Two-dimensional problems in Cartesian Co-ordinates - Airys stress function.

UNIT II

Three-dimensional problems - Analysis of stress and strain - Pure bending of a prismatic bar – Vector of equilibrium equations - solution of equilibrium equations - Use of potential functions - Bettis method - Method of integral transforms - Simple applications.

UNIT III

Energy methods - Castiglianos theorem - Principle of Virtual work - Principle of stationary potential energy - Principle of least work - Rayleighs method - Rayleigh-Ritz method- inite difference method - Simple applications.

UNIT IV

Plasticity - Plastic deformation - Mechanism - Factors affecting plastic deformation - Strain hardening - Luders lines - Plastic stress-strain relations - Empirical equations - Theory of plastic flow - Concept of plastic potential - Yield criteria - Yield conditions - Experimental evidence - Geometric representation of yield criteria. Plastic deformation in tension – Stress strain curves - Advantages of true Stress strain diagram - Stress in the neck of a cylindrical specimen and in the neck of a flat plate in tension and sphere under internal pressure - Instability in compression.

UNIT V

Plastic bending of beams - Idealised Stress strain diagram - Residual stresses in plastic bending – Plastic bending of unsymmetrical sections - Deflection under plastic bending. Plastic Torsion - Circular and non-circular shafts - Residual stresses - Sand heap analogy – Shape factors in torsion.

TEXT BOOKS

1. Stephen Timoshenko, J N Goodier, Theory of Elasticit,McGraw-Hill, New Delhi, 2003.
2. Sadhusingh, Theory of Elasticity, Khanna Publishers, New Delhi, 1988.

REFERENCE BOOKS

1. Johnson W, P B Mellor, Plasticity for Mechanical Engineers, Princeton, N.J.Van Nostrand, London, 1966.

CZMISCN	URBAN AND RURAL PLANNING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To enable students to develop knowledge on Urban and rural planning.
- To introduce the regulations and laws related to urban planning.
- To educate the importance of zoning in planning.
- To get to know the principles involved in planning public buildings.

UNIT I

Objects of town planning–Economic justification–Principles of Town Planning–Necessity of Town Planning–Growth of Towns– Natural and planned growth–stages in Town Development– Distribution of Land use–Forms of planning–Development of Town Planning in Ancient India–Concepts of Modern Town Planning and its stages.

UNIT II

Types of surveys–Collection of Data– Importance of zoning– Classification of Zoning–Use of zoning–Height zoning–Density zoning –Housing–Planning of neighbourhood units–Types of Layouts – Classification of housing– Housing problems in India.

UNIT III

Parks and Playgrounds–Schools–Public buildings and Town Centres– Industries–Industrial Estates–Communication and Traffic system–Traffic surveys –Traffic congestions–Types of road junctions– Parking facilities –Street lighting.

UNIT IV

Urban Renewal – Replanning of the existing towns – Objects of replanning–Necessity of Replanning – Advantages of Master plan– Data and Maps–Features of Master plan–Implementation of Master Plan–Planning law and Legislation in India–Building Byelaws–Functions of Local authority–Development –Control Rules for Metropolitan and District Municipalities.

UNIT V

Concept of rural planning–Urban and Rural differences– Urbanization –Principles of Ruralplanning–Village redevelopment–Integral Rural development program–Rural housing–Principles–Design of Rural Housing–Rural Housing schemes –Group housing–Environmental Sanitation in Rural planning– Usage of low cost materials.

TEXT BOOKS

1. Hiraskar. K.G., *Fundamentals of Town Planning*, Danpatrai & Sons., New Delhi, 2012
2. Rangwala. S.C., *Town Planning,* Charotar Publishing House Pvt. Limited, Gujarat, 2009.

REFERENCES

1. Chennai Metropolitan Development Authority, Second Master Plan for Chennai, Government of Tamilnadu, Chennai, 2008.
2. Tamilnadu Town and Country Planning Act 1971,Government of Tamilnadu, Chennai.
3. Goel. S.L.,Urban Development and Management, Deep and Deep Publications, New Delhi, 2002.
4. Thooyavan. K.R., Human Settlements – A Planning Guide to Beginners, M.A.Publications, Chennai, 2005.