ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY

M.E (Two-Year Full Time) DEGREE PROGRAM
Choice Based Credit System

Regulations - 2023

Curriculum for Students Admitted in the Academic Year 2023-2024

HAND BOOK
2023

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

M.E. (STRUCTURAL ENGINEERING)

Choice Based Credit System

(Full -Time)

CURRICULUM AND SYLLABI

BASED ON

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MEETING OF BOARD OF STUDIES IN

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21.01.2023

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

M.E. (Two -Year Full Time) DEGREE PROGRAMME (CBCS)

REGULATIONS - 2023

1. Conditions for Admission

Candidates for admission to the first year of the four-semester **M.E Degree Programme in Engineering** shall be required to have passed B.E / B.Tech degree of Annamalai University or any other authority accepted by the syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

2. Branches of Study in M.E

The Branch and Eligibility criteria of Programmes are given in Annexure

3. Courses of Study

The courses of study along with the respective syllabi and the scheme of Examinations for each of the M.E Programmes offered by the different Departments of study in the Faculty of Engineering and Technology are given in Annexures of the respective Departments.

4. Choice Based Credit System (CBCS)

The curriculum includes Program Core, Program Electives and Open Electives, Mandatory Learning Courses and Audit Courses in addition to the Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.

5. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture / tutorial per week and 0.5 credit for one hour of laboratory or project or industrial training or seminar per week. The total credits for the Programme will be **68**.

6. Duration of the Programme

A student of M.E Programme is normally expected to complete in four semesters for the full-time but in any case not more than four years from the date of admission.

7. Registration for Courses

A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option. Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late

registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done up to the last working day. Registration for the Thesis Phase - I and Phase-II shall be done at the appropriate semesters.

8. Electives

8.1 Program Electives

The student has to select two electives in first semester, another two electives in the second semester and one more in the third semester from the list of Program Electives.

8.2 Open Electives

The student has to select two electives in third semester from the list of Open Electives offered by the Department and / or other departments in the Faculty of Engineering and Technology.

9. Industrial Project

A student may be allowed to take up the one program elective and two open elective courses of third semester (Full Time program) in the first and second semester, to enable him/her to carry out Project Phase-I and Phase-II in an industry during the entire second year of study. The condition is that the student must register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Assessment

10.1 Theory Courses

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	:	08 marks
Second assessment (Mid-Semester Test-II)	:	12 marks
Third Assessment	:	05 marks
End Semester Examination	:	75 marks

10.2 Practical Courses

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	:	15 marks
Second assessment (Test-II)	:	15 marks
Maintenance of record book	:	10 marks
End Semester Examination	:	60 marks

10.3 Thesis Work

The thesis Phase-I will be assessed for 40 marks by a committee consisting of the Head of the Department, the guide and a minimum of two members nominated by the Head of the Department. The Head of the Department will be the chairman. The number of reviews must be a minimum of three per semester. 60 marks are allotted for the thesis work and viva voce examination at the end of the third semester. The same procedure will be adopted for thesis Phase II in the fourth semester.

10.4 Seminar / Industrial Training

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of the seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

11. Student Counselors (Mentors)

To help the students in planning their course of study and for general advice on the academic Programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counselor (mentor) for those students throughout their period of study.

12. Class Committee

For each of the semesters of M.E programmes separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semesters for Full time will be as follows:

- Teachers of the individual courses.
- A Thesis coordinator (for Thesis Phase - I and II) shall be appointed by the Head of the Department from among the Thesis supervisors.
- A thesis review committee chairman shall be appointed by the Head of the Department
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All counselors of the class and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be special invitees.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory courses / 40 marks for practical courses, for Industrial Training and for Thesis work (Phase-I and Phase-II) will be finalized for every student and tabulated and submitted to the Head of the Department for approval and transmission to the Controller of Examinations.

13. Temporary Break of Study

A student can take a one-time temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid- semester test. However, the student must complete the entire Programme within the maximum period of **four years.**

14. Substitute Assessments

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice - Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register and repeat the same semester in the subsequent academic years.

16. Passing and Declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average (GPA) and cumulative grade point average (CGPA) and prepare the mark sheets.

90 to 100 marks	Grade S‘
80 to 89 marks	Grade A‘
70 to 79 marks	Grade B‘
60 to 69 marks	Grade C‘
55 to 59 marks	Grade D‘
50 to 54 marks	Grade E‘
Less than 50 marks	Grade RA‘
Withdrawn from the Examination	Grade W‘

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA – 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

17. Awarding Degree

After successful completion of the Programme, the degree will be awarded with the following classifications based on CGPA.

For First Class with Distinction the student must earn a minimum of 68 credits within four

semesters from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class, the student must earn a minimum of 68 credits within two years and six months from the time of admission and obtain a CGPA of 6.75 or above.

For Second class, the student must earn a minimum of 68 credits within four years from the time of admission.

The conversion of OGPA/CGPA (from I semester to IV Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

Percentage of marks = (OGPA/CGPA - 0.25) x 10

Where $\boldsymbol{OGPA/CGPA} = \frac{\sum C_i GP_i}{\sum C_i}$

C_i- Credit hours of a course

GP_i - Grade Point of that course

18. Ranking of Candidates

The candidates who are eligible to get the M.E degree in First Class with Distinction will be ranked on the basis of CGPA for all the courses of study from I to IV semester.

The candidates passing with First Class and without failing in any subject from the time of admission will be ranked next to those with distinction on the basis of CGPA for all the courses of study from I to IV semester.

19. Transitory Regulations

If a candidate studying under the old regulations M.E could not attend any of the courses in his/her courses, shall be permitted to attend equal number of courses, under the new regulation and will be examined on those subjects. The choice of courses will be decided by the concerned Head of the department. However he/she will be permitted to submit the thesis as per the old regulations. The results of such candidates will be passed as per old regulations.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

ANNEXURE

S. No.	Department		Programme (Full Time)	Eligible B.E. / B.Tech Programme
1	Civil Engineering	i	Environmental Engineering	B.E. / B.Tech - Civil Engineering, Civil &Structural Engineering, Environmental Engineering, Mechanical Engineering, Industrial Engineering, Chemical Engineering, Bio Chemical Engineering, Biotechnology, Industrial Biotechnology, Chemical & Environmental Engineering.
		ii	Water resources Engineering & Management	B.E. / B.Tech - Civil Engineering, Civil &Structural Engineering, Environmental Engineering, Mechanical Engineering, Agricutural and irrigation Engineering, Geo informatics, Energy and Environmental Engineering.
2	Civil & Structural Engineering	i	Structural Engineering	B.E. / B.Tech - Civil Engineering, Civil & Structural Engineering.
		ii	Construction Engineering. and Management	
3	Mechanical Engineering	i	Thermal Power	B.E. / B.Tech - Mechanical Engineering, Automobile Engineering, Mechanical Engineering (Manufacturing).
		ii.	Energy Engineering & Management	B.E. / B.Tech - Mechanical Engineering, Automobile Engineering, Mechanical (Manufacturing) Engineering, Chemical Engineering
4	Manufacturing Engineering	i	Manufacturing Engineering	B.E. / B.Tech - Mechanical Engineering, Automobile Engineering, Manufacturing Engineering, Production Engineering, Marine Materials science Engineering,Metallurgy
5	Electrical Engineering	i	Power System Engineering	B.E. / B.Tech - Electrical and Electronics Engineering,
6	Electronics & Instrumentation Engineering	i	Process Control & Instrumentation	B.E. / B.Tech - Electronics and Instrumentation Engineering, Electrical and Electronics Engineering, Control and Instrumentation Engineering, Instrumentation Engineering, , Electronics and Communication Engineering,

7	Chemical Engineering	i	Chemical Engineering	B.E. / B.Tech - Chemical Engineering, Petroleum Engineering, Petrochemical Technology
		ii	Food Processing Technology	B.E. / B.Tech - Chemical Engineering, Food Technology,Biotechnology, Biochemical Engineering, Agricultural Engineering.
S. No.	**Department**		**Programme (Full Time)**	**Eligible B.E. / B.Tech Programme**
8	Computer Science and Engineering	i	Computer Science and Engineering	B.E. / B.Tech - Computer Science and Engineering, Computer Science and Engineering (Artificial Intelligence and Machine Learning), Computer Science and Engineering (Data Science), Information Technology, Electronics & Communication Engineering, Software Engineering
9	Electronic & Communication Engineering	i.	Communication Systems	B.E. / B.Tech -Electronics and Communication Engineering, Electronics Engineering.

DETAILS OF COURSE CODE

S. No	**3rd & 4th Digits**	**DETAILS**		**5th & 6th Digits**	**DETAILS**	**7th & 8th Digits**	**DETAILS**
1	CE	Civil Engineering	i	WR	Water Resources Engineering & Management	PC	Program Core
			ii	EE	Environmental Engineering		
2	CZ	Civil & Structural Engineering	i	SE	Structural Engineering	PE	Program Elective
			ii	CM	Construction Engineering. and Management		
3	ME	Mechanical Engineering	i	TP	Thermal Power Engineering	OE	Open Elective
			ii	EM	Energy Engineering & Management		
4	MF	Manufacturing Engineering	i	ME	Manufacturing Engineering	CP	Core Practical
5	EE	Electrical Engineering	i	PS	Power System Engineering	TS	Industrial Training and

							Seminar
6	EI	Electronics & Instrumentation Engineering	i	PC	Process Control & Instrumentation	PV	Project work & Viva-voce
7	CH	Chemical Engineering	i	CE	Chemical Engineering	MC	Mandatory Learning Course
			ii	FT	Food Processing Technology		
8	CS	Computer Science and Engineering	i	CS	Computer Science and Engineering	AC	Audit Course
S. No	**3rd & 4th Digits**	**DETAILS**		**5th & 6th Digits**	**DETAILS**	**7th & 8th Digits**	**DETAILS**
9	EC	Electronics & Communication Engineering	i	CS	Communication Systems		
10	YY	Name of the Department					
11	ZZ	Name of the Program					

The first two digits relate to the year from which the Regulations commence
9th digit represents the semester and 10th digit represents the serial number of courses.
YY and ZZ relates to the Open Elective where YY corresponds to Name of the Department and ZZ to Name of the Program.

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

M.E. (STRUCTURAL ENGINEERING) - FULL TIME

COURSES OF STUDY AND SCHEME OF EXAMINATIONS

SEMESTER I

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
23CZSEPC11	PC - I	Advanced Structural Analysis	3	-	-	25	75	100	3
23CZSEPC12	PC - II	Advanced Solid Mechanics	3	-	-	25	75	100	3
23CZSEPE13	PE - I	Program Elective – I	3	-	-	25	75	100	3
23CZSEPE14	PE - II	Program Elective – II	3	-	-	25	75	100	3
23CZSEMC15	MC	Research Methodology and IPR	2	-		25	75	100	2
23CZSECP16	CP- I	Structural Design Lab	-	-	3	40	60	100	2
23CZSECP17	CP- II	Advanced Concrete Lab	-	-	3	40	60	100	2
23CZSEAC18	AC - 1	Audit Course – I	-	-	-	-	-	-	-
					Total	**205**	**495**	**700**	**18**

SEMESTER II

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
23CZSEPC21	PC - III	FEM in Structural Engineering	3	-	-	25	75	100	3
23CZSEPC22	PC - IV	Structural Dynamics	3	-	-	25	75	100	3
23CZSEPE23	PE - III	Program Elective – III	3	-	-	25	75	100	3
23CZSEPE24	PE - IV	Program Elective – IV	3	-	-	25	75	100	3
23CZSEOE25	OE - I	Open Elective - I	3	-	-	25	75	100	3
2CZSECP26	CP - III	Numerical Analysis Lab and Model Testing Lab	-	-	3	40	60	100	2
23CZSETS27	TS	Industrial Training & Seminar / Mini Project	-	Tr 2	S 2	40	60	100	2
23CZSEAC28	AC - 2	Audit Course -II	-	-	-	-	-	-	-
					Total	**205**	**495**	**700**	**19**

SEMESTER III

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
23CZSEPE31	PE - V	Program Elective – V	3	-	-	25	75	100	3
23CZSEOE32	OE - II	Open Elective - II	3	-	-	25	75	100	3
23CZSEPV33	PV - I	Project work & Viva-voce Phase – I	-	Pr 16	S 4	40	60	100	10
23CZSEPV34	AC - 3	Audit Course - III							
					Total	**90**	**210**	**300**	**16**

SEMESTER IV

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
23CZSEPV41	PV - II	Project work & Viva-voce Phase – II	-	Pr 26	S 6	40	60	100	16
					Total	**40**	**60**	**100**	**16**

L - Lecture; P - Practical; T - Tutorial; CA - Continuous Assessment;

FE - Final Examination; MC - Mandatory Learning Course

PROGRAM ELECTIVES

Sl.No.	COURSE CODE	LIST OF PROGRAM ELECTIVES	Credits
1.	23CZSEPE13	Design of Advanced Concrete Structures	3
2.	23CZSEPE14	Structural Health Monitoring	3
3.	23CZSEPE23	Advanced Steel Design	3
4.	23CZSEPE24	Design of Prestressed Concrete Structures	3
5.	23CZSEPE31	Design of Form work	3
6.	23CZSEPEXX	Theory of Thin Plates and Shells	3
7.	23CZSEPEXX	Theory and Application of Cement Composites	3
8.	23CZSEPEXX	Theory of Structural Stability	3
9.	23CZSEPEXX	Analytical and Numerical Methods for Structural Engineering	3
10.	23CZSEPEXX	Structural Optimization	3
11.	23CZSEPEXX	Design of Masonry Structures	3
12.	23CZSEPEXX	Advanced Design of Foundations	3
13.	23CZSEPEXX	Soil Structure Interaction	3
14.	23CZSEPEXX	Design of Industrial Structures	3
15.	23CZSEPEXX	Analytical and Finite Element Analysis of Laminated Composite Plates	3
16.	23CZSEPEXX	Fracture Mechanics of Concrete Structures	3
17.	23CZSEPEXX	Design of Plates and Shells	3
18	23CZSEPEXX	Strength and Deformation of RC Members	3

OPEN ELECTIVES

Sl.No.	COURSE CODE	LIST OF OPEN ELECTIVES	Credits
1.	23CZSEOE25	Design of High Rise Structures	3
2.	23CZSEOE32	Composite Materials	3
3.	23CZSEOEXX	Business Analytics	3
4.	23CZSEOEXX	Industrial Safety	3
5.	23CZSEOEXX	Operations Research	3
6.	23CZSEOEXX	Cost Management of Engineering Projects	3
7.	23CZSEOEXX	waste to Energy	3
8.	23CZSEOEXX	Special Concretes	

AUDIT COURSES

Sl.No.	COURSE CODE	LIST OF AUDIT COURSES
1.	23CZSEAC18	Stress Management by Yoga
2.	23CZSEAC28	English for Research Paper Writing
3.	23CZSEAC34	Constitution of India
4.	23CZSEACXX	Disaster Management
5.	23CZSEACXX	Sanskrit for Technical Knowledge
6.	23CZSEACXX	Value Education
7.	23CZSEACXX	Pedagogy Studies
8.	23CZSEACXX	Personality Development through Life Enlightenment Skills

DEPARTMENT OF CIVIL & STRUCTURAL ENGINEERING

VISION

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

MISSION

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

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

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

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

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

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

PEO1	To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the field of Structural Engineering domain feeding the needs of global expectations with professional competence.
PEO2	To enable the graduates to apply sustained learning, their engineering skills and adopting to multidisciplinary situations through graduate work.
PEO3	To expose the students to the latest innovations and trends in the field of Structural Engineering in theory, professional development and self-study in Structural Engineering and Practice and tuning the academic programmes periodically to make the students fit for a professional job, a research assignment or self-employment.
PEO4	To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or in a path to pursue graduate education master and doctoral degree.
PEO5	To produce Structural Engineers who integrate and build on the program's core curricular concepts in the pursuit of professional leadership, teamwork, life-long learning, and successful career advancement.

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

PO1	**Scholarship of Knowledge** Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.
PO2	**Critical Thinking** Analyse complex engineering problems critically, apply independent judgement for synthesising information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
PO3	**Problem Solving** Think laterally and originally, conceptualise and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
PO4	**Research Skill** Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
PO5	**Usage of modern tools** Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.
PO6	**Collaborative and Multidisciplinary work** Possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.
PO7	**Project Management and Finance** Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.
PO8	**Communication** Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
PO9	**Life-long Learning** Recognise the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10	**Ethical Practices and Social Responsibility** Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.
PO11	**Independent and Reflective Learning** Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

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 PEO with Mission					
	M1	**M2**	**M3**	**M4**	**M5**
PEO1	3	1	3	1	1
PEO2	3	3	1	1	1
PEO3	3	3	3	3	3
PEO4	1	3	1	3	1
PEO5	1	1	3	3	3

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

SEMESTER I

23CZSEPC11	ADVANCED STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Influence Coefficients

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

Stiffness Method applied to Large Frames

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

Applications to Simple Problems

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

Boundary Value Problems (BVP)

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

Linear Element

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPC12	ADVANCED SOLID MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction to Elasticity

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

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

Two-Dimensional Problems of Elasticity

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

Torsion of Prismatic Bars

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

Plastic Deformation

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

REFERENCES:

1. Timoshenko S. And Goodier J. N., Theory of Elasticity, McGraw Hill, 1961.
2. Sadd M.H., Elasticity, Elsevier, 2005.
3. Ragab A. R., Bayoumi S.E., Engineering Solid Mechanics, CRC Press, 1999.
4. Ameen M., Computational Elasticity, Narosa, 2005.
5. Kazimi S. M. A., Solid Mechanics, Tata McGraw Hill, 1994.
6. Srinath L.S., Advanced Mechanics of Solids, Tata McGraw Hill, 2000.

COURSE OUTCOMES:

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

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

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

23CZSEMC15	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSECP 16	STRUCTURAL DESIGN LAB	L	T	P	C
		3	0	0	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSECP 17	ADVANCED CONCRETE LAB	L	T	P	C
		3	0	0	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS

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

REFERENCES:

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

COURSE OUTCOMES:

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

1. Understand the fundamentals of concrete mix design
2. Design concrete mixes using national and international codes of practice
3. Understand the flexural behaviour of RC beams
4. Understand the shear behaviour of RC beams
5. Conduct non-destructive testing on concrete elements.

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

SEMESTER II

23CZSEPE 21	FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction

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

Beam Elements

Flexure Element, Element Stiffness Matrix, Element Load Vector.

Method of Weighted Residuals

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

Application to Solid Mechanics

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPC22	STRUCTURAL DYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction

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

Numerical Solution

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

Multiple Degree of Freedom System (Lumped parameter)

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

Multiple Degree of Freedom System (Distributed Mass and Load)

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

Special Topics in Structural Dynamics (Concepts only)

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSECP26	NUMERICAL ANALYSIS LAB AND MODEL TESTING LAB	L	Tr	S	C
		0	2	2	2

COURSE OBJECTIVES:

- To find roots of nonlinear equations by bisection method and newton's method.
- To study the system of linear equations using gauss- elimination/gauss-Seidal Iteration/ gauss-Jorden method.
- To integrate using trapezoidal and Simpson's rules.
- To find the numerical solution of ordinary differential equations by Euler's method, Runge-kutta method.
- To learn response of structural models under static and dynamic conditions.

LIST OF EXPERIMENTS (NUMERICAL ANALYSIS LAB)

1. Find the roots of Non-Linear Equation Using Bisection methods.
2. Find the roots of Non-Linear Equation Using Newton's methods.
3. Curve fitting by least square approximation
4. Solve the system of Linear Equation Using Gauss-elimination Method.
5. Solve the system of Linear Equation Using Gauss-seidal iteration Method.
6. Solve the system of Linear Equation Using Gauss-Jorden Method.
7. Integrate numerically using Trapezoidal rule.
8. Integrate numerically using Simpson's rule.
9. Numerical solutions of ordinary Differential equations by Euler's methods.
10. Numerical solutions of ordinary Differential equations by Runge – Kutta method

LIST OF EXPERIMENTS (MODEL TESTING LAB)

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

COURSE OUTCOMES:

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

1. Understand roots of non linear equations by bisection method and newton's method.
2. Solve the system of linear equations using gauss- elimination/gauss-Seidal Iteration/ gauss-Jorden method.
3. Integrate numerically using trapezoidal and simpson's rules.
4. Solve the numerical solution of ordinary differential equations by Euler's method, Runge-kutta method.
5. To understand the response of structures under static and dynamic conditions.

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

23CZSETS27	INDUSTRIAL TRAINING & SEMINAR / MINIPROJECT	L	Tr	S	C
		0	2	2	2

COURSE OBJECTIVES:

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

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

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

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

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

COURSE OUTCOMES:

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

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

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

SEMESTER III

23CZSEPV33	PROJECT WORK AND VIVA-VOCE PHASE - I	L	Pr	S	C
		0	16	4	10

COURSE OBJECTIVES:

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

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

COURSE OUTCOMES:

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

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

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

SEMESTER IV

23CZSEPV41	PROJECT WORK AND VIVA-VOCE PHASE- II	L	Pr	S	C
		0	24	6	15

COURSE OBJECTIVES:

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

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

COURSE OUTCOMES:

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

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

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

PROGRAM ELECTIVES

23CZSEPE13	DESIGN OF ADVANCED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Deflection and crack width – estimation based on IS 456, BS 8110, EC and ACI method.

Redistribution of moments in RC beams – Condition for moment redistribution – moment redistribution in fixed beam and two span continuous beam – Advantages

Design of deep beams, spandrel beams – Analysis of grid floors.

Analysis, design and detailing of shear walls.

Machine foundations – Types – General requirements – Design parameters – Design criteria and Codal provisions for reciprocating and Rotary type machines.

REFERENCES:

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

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COURSE OUTCOMES:

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

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

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

23CZSEPE14	STRUCTURAL HEALTH MONITORING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Structural Health:

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

Structural Audit:

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

Static Field Testing:

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

Dynamic Field Testing:

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

Introduction to Repairs and Rehabilitations of Structures:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPE23	ADVANCED STEEL DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Properties of Steel:

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

Design of Steel Structures:

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

Stability of Beams:

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

Method of Designs:

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

Connections:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPE24	DESIGN OF PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

1. Lin T.Y., Design of Prestressed Concrete Structures, Asia Publishing House, 1955.
2. Krishnaraju N., Prestressed Concrete, Tata McGraw Hill, New Delhi, 1981.
3. Guyan Y., Limited State Design of Prestressed Concrete, Applied Science Publishers, 1972.
4. IS: 1343- Code of Practice for Prestressed Concrete
5. IRC: 112

COURSE OUTCOMES:

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

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

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

23CZSEPE31	DESIGN OF FORMWORK	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction:

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

Formwork Design:

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

Formwork Design for Special Structures:

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

Flying Formwork:

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

Formwork Failures:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	THEORY OF THIN PLATES AND SHELLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction:

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

Static Analysis of Plates:

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

Circular Plates:

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

Static Analysis of Shells:

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

Shells of Revolution:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	THEORY AND APPLICATIONS OF CEMENT COMPOSITES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction:

Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Mechanical Behaviour:

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

Cement Composites:

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

Mechanical Properties of Cement Composites:

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

Application of Cement Composites:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	THEORY OF STRUCTURAL STABILITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Criteria for Design of Structures:

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

Stability of Columns:

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

Stability of Frames:

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

Stability of Beams: lateral torsion buckling.

Stability of Plates:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Fundamentals of Numerical Methods:

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

Solution of Nonlinear Algebraic and Transcendental Equations –

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

Numerical Differentiation & Integration:

Solution of Ordinary and Partial Differential Equations.

Finite Difference scheme: Implicit & Explicit scheme.

Computer Algorithms:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	STRUCTURAL OPTIMIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction: Simultaneous Failure Mode and Design, Classical External Problems.
Calculus of Variation: Variational Principles with Constraints,
Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,
Geometric Programming **and** Stochastic Programming.
Applications: Structural Steel and Concrete Members, Trusses and Frames - Design:Frequency Constraint, Design of Layouts.

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	DESIGN OF MASONRY STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction:

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

Flexural Strength of Reinforced Masonry Members:

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

Shear Strength and Ductility of Reinforced Masonry Members.

Prestressed Masonry:

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	ADVANCED DESIGN OF FOUNDATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	SOIL STRUCTURE INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	DESIGN OF INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Steel Gantry Girders

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

Steel Bunkers and Silos

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

Chimneys

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

Water Tanks

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

Design of prestressed steel water tank

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	ANALYTICAL AND FINITE ELEMENT ANALYSIS OFLAMINATED COMPOSITE PLATES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	FRACTURE MECHANICS OF CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

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

Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling.

REFERENCES:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
2. Broek David, Elementary Engineering Fracture Mechanics, 3rd Rev. Ed. Springer, 1982.
3. Elfgreen L., Fracture Mechanics of Concrete Structures – Theory and Applications, RILEM Report, Chapman and Hall, 1989.
4. Victor, Li C., Bazant Z. P., Fracture Mechanics – Applications to Concrete, ACI SP 118, ACI Detroit, 1989.

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	DESIGN OF PLATES AND SHELLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEPEXX	STRENGTH AND DEFORMATION OF RC MEMBERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- This course provides the advanced knowledge of concrete technology which covers the properties of fresh and hardened concrete and the concept of durability.
- New concrete making materials and recent advancements in concrete technology such as High strength concrete, high performance concrete, Fiber reinforced concrete and self-compacting concrete.

Behaviour of concrete - Uni-axial Stress Behaviour - Combined Stress Behaviour - Concrete confinement by Reinforcement - Monotonic Stress Behaviour - Repeated Stress Behaviour - Reversed Stress Behaviour.

Strength and Deformation of Members with Flexure - Moment - Curvature Relationships - Ductility of Unconfined Beam Sections - Ductility of Unconfined Column Sections - Flexural Deformation of Members - Deformation of Members with Cyclic Loading.
Strength and Deformation of Members with Shear - Mechanism of Shear Resistance in RC Beams without and with Shear Reinforcement - Interaction of Shear and Flexure - Interaction of Shear, Flexure and Axial Forces - Shear Deformations - Effects of Repeated and Cyclic Loadings on shear Strength.

Strength and Deformation of Members with Torsion - Beams subjected to Torsion and Flexure without Web Reinforcement - Beams subjected to Torsion and Shear without and with Web Reinforcement.

Bond and Anchorage - Mechanisms - Bond Failure Modes - Factors influencing Bond Strength - Flexural Bond - Anchorage Bond.

Service Load Performance - Deflection - Need for Deflection Control - Methods of Deflection Control - Calculation of Deflections - Cracking - Need for Crack Control - Calculation of crack width - Control of Flexural Cracks in Design.

REFERENCES:

1. Park, R. and Paulay, T., *Reinforced Concrete Structures*, John Wiley & Sons,New York, 1975.
2. Unnikrishna Pillai, S. and DevdasMenon, *Reinforced Concrete Design,* Tata McGraw-Hill Publishers, New Delhi, 2004.
3. Nilson, A.H., *Design of concrete Structures*, McGraw - Hill Company, Inc., New York, 1997.
4. Mosely, W.H. and Bungey, J.H., *Reinforced Concrete Design*, Macmillan Ltd.,London, 1990.

COURSE OUTCOMES:

1. To understand various behavior of Concrete
2. To understand the moment curvature relationship of RCC
3. To understand the deformation characteristics of RCC under Torsion
4. To identify bond performance of concrete with Reinforcement
5. To acquire the knowledge on the serviceability criteria of RCC Members

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

OPEN ELECTIVES

23CZSEOE25	DESIGN OF HIGH RISE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

Firefighting:Design provisions.

Application of software in analysis and design.

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEOE32	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction:

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

Reinforcements:

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

Manufacturing of Metal Matrix Composites:

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

Manufacturing of Polymer Matrix Composites:

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

Strength:

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro thermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEOEXX	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

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

Business analytics:

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

Trendiness and Regression Analysis:

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

Organization Structures of Business analytics:

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

Forecasting Techniques:

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

Decision Analysis:

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

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

REFERENCES:

1. Marc J. Schniederjans, Dara G. Schniederjan. S, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications Pearson FT Press.
2. James Evans, Business Analytics, persons Education.

COURSE OUTCOMES:

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

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

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

23CZSEOEXX	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Industrial safety:

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

Fundamentals of maintenance engineering:

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

Wear and Corrosion and their prevention:

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Fault tracing:

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

Periodic and preventive maintenance:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEOEXX	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEOEXX	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction and Overview of the Strategic Cost Management Process

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

Project:

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

Project team:

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

Cost Behavior and Profit Planning Marginal Costing:

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

Budgetary Control:

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

1. Understand cost accounting knowledge, such as terminology and fundamental principles and methods.
2. Plan project execution.
3. Plan project cost control.
4. Apply TQM practices.
5. Apply course material to new situations.

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

23CZSEOEXX	WASTE TO ENERGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Introduction to Energy from Waste:

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

Biomass Pyrolysis:

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

Biomass Gasification:

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

Biomass Combustion:

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

Biogas:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEOEXX	SPECIAL CONCRETES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide students with a basic knowledge regarding the Micro structures, types of concretes.

Introduction

Micro structure aspect of cement paste - Hydrated Portland cement gel mechanism - Application and specification of admixtures & other cement replacement materials – Difference between quarry dust and M sand - concrete made with M sand - Physical and chemical properties - Properties of fresh and hardened concrete - Durability study on M sand concrete - Manufacture of Concrete – Properties of materials used – Fresh and Hardened Concrete.

Steel Slag Concrete

Cementitious properties of steel slag powder - Steel slag as fine & coarse aggregate – Properties of fresh and hardened concrete- Durability study on steel slag concrete - **Glass Concrete -** Cementitious properties of glass powder - Glass waste as fine & coarse aggregate – Properties of fresh and hardened concrete - Durability study on Glass concrete - **Fibre Reinforced Concrete -** Different types of fibres – Natural and Synthetic fibres - Aspect ratio – High fibre volume – Micro fibre system – Properties of fresh and hardened concrete.

Polymer and Geopolymer Concrete

Polymer concrete – Types – Polymer impregnated concrete – Polymer modified concrete – Properties – Stress – Strain relationship – Compressive strength – Durability – Applications.

Geopolymers – materials in geopolymer concrete- mix proportion – mixing, casting, compaction and curing of geopolymer concrete - Design of geopolymer concrete mixes-short term and long term properties – Durability studies – economic benefit of geopolymer concrete. Potential uses of different by product materials – Fly ash, Glass Waste, Steel slag, M sand, GGBS – Performance characteristics – Recommendations, Practice and Precautions in making of Geopolymer concrete.

Nano Concrete

Types of Nano materials- characterization-properties-pozzolanic reaction-filler action-microstructure of Nano concrete-properties of Nano concrete-fresh and hardened stage-Nano materials with admixtures-cementitious materials: fly ash-silica fume-GGBS-metakoalin. – advantages and disadvantages of nano concrete-application of nano concrete.

Other Concretes

Use of different industrial waste in concrete for filler- binder-characterization-mix proportions-High Strength and High Performance Concrete - Properties and mix proportioning of fly ash concrete, silica fume concrete, Self compacting concrete, Light weight concrete, Ultra high strength concrete, Ready mix concrete, High strength concrete, High Density Concrete, Recycled aggregate concrete, Bacterial concrete – **Ferrocement -** ferrocement Materials and properties - Admixtures- Casting technique - Hand plastering- Mechanised process – Guniting – Applications.

REFERENCES:

1. Gambhir, M.L., *Concrete Technology*, Tata McGraw Hill, New Delhi.
2. Shetty M.S., *Concrete Technology*, Chand & Co. Ltd, New Delhi.
3. Mehta P. Kumar and Monteiro, Paulo J.M., Concrete Micro structure, Indian Concrete Institute, Chennai
4. Neville Brooks, *Concrete Technology*, Addison – Wesley, England.
5. John Newman and Ban Seng Choo, *Concrete Technology*, Vol. I to IV, Elsevier, 2003.
6. Hardjito. D and Rangan. B. V (2005), *Development and properties Low calcium fly ashbased Geopolymer concrete*, Research Report, GC1, GC2, GC3, Faculty Engineering, Curtain University of Technology, Perth.

COURSE OUTCOMES:

1. To understand the manufacturing process, gel mechanism and durability aspects of cement and concrete
2. To understand the manufacturing and qualities of steel slag concrete.
3. To know about Polymer and Geopolymer Concrete.
4. To Perceive the knowledge on Nano – Concrete
5. To Grasp the behavior of other types of concrete

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

AUDIT COURSES

23CZSEAC18	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEAC28	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

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

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

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEAC34	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

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

Contours of Constitutional Rights & Duties: Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and EducationalRights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEACXX	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

Repercussions of Disasters And Hazards:

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

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

Disaster Prone Areas In India:

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

Disaster Preparedness and Management:

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

Risk Assessment:

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

Disaster Mitigation:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEACXX	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

Alphabets in Sanskrit - Past/Present/Future Tense - Simple Sentences Order

Introduction of roots

Technical information about Sanskrit Literature

Technical concepts of Engineering-Electrical, Mechanical -

Architecture, Mathematics

REFERENCES:

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

COURSE OUTCOMES

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

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

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

23CZSEACXX	VALUE EDUCATION	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

Values and self-development –Social values and individual attitudes - Work ethics, Indian vision of humanism - Moral and non- moral valuation - Standards and principles - Value judgments.

Importance of cultivation of values - Sense of duty. Devotion- Self-reliance - Confidence, Concentration – Truthfulness – Cleanliness Honesty, Humanity - Power of faith, National Unity – Patriotism - Love for nature - Discipline

Personality and Behavior Development - Soul and Scientific attitude - Positive Thinking. Integrity and discipline -Punctuality, Love and Kindness - Avoid fault Thinking - Free from anger, Dignity of labour - Universal brotherhood and religious tolerance - True friendship - Happiness Vs suffering, love for truth - Aware of self-destructive habits - Association and Cooperation - Doing best for saving nature.

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

23CZSEACXX	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

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

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

1. Pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
2. Evidence on the effectiveness of these pedagogical practices.
3. Teacher education (curriculum and practicum) and the school curriculum and guidance materials that best support effective pedagogy.
4. The barriers to learning.
5. The research gaps and future directions.

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

23CZSEACXX	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

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

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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