HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

(Estd. u/s 3 of the UGC Act, 1956)

Padur, Kancheepuram District - 603 103.

DEPARTMENT OF CIVIL ENGINEERING

Regulations Curriculum and Syllabus 2013

M.Tech. STRUCTURAL ENGINEERING

ACADEMIC REGULATIONS
(M.TECH./ M.B.A. / M.C.A.) (Full - Time / Part - Time)
(Effective 2013-14)

1. Vision, Mission and Objectives

1.1 The Vision of the Institute is "To make every man a success and no man a failure".

In order to progress towards the vision, the Institute has identified itself with a mission to provide every individual with a conducive environment suitable to achieve his / her career goals, with a strong emphasis on personality development, and to offer quality education in all spheres of engineering, technology, applied sciences and management, without compromising on the quality and code of ethics.

1.2 Further, the institute always strives

- To train our students with the latest and the best in the rapidly changing fields of Engineering, Technology, Management, Science & Humanities.
- To develop the students with a global outlook possessing, state of the art skills, capable of taking up challenging responsibilities in the respective fields.
- To mould our students as citizens with moral, ethical and social values so as to fulfill their obligations to the nation and the society.
- To promote research in the field of science, Humanities, Engineering, Technology and allied branches.

1.3 Our aims and objectives are focused on

- Providing world class education in engineering, technology, applied science and management.
- Keeping pace with the ever changing technological scenario to help our students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.
- To inculcate a flair for research, development and entrepreneurship.

2. Admission

2.1 The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, following guidelines issued by Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the (M.TECH / M.B.A. / M.C.A.) programme will be decided by BOM as per the directives from Ministry of Human Resource Development (MHRD), Government of India and taking into account the market demands. Some seats for Non Resident Indians and a few seats for foreign nationals shall be made available.

2.2 The selected candidates will be admitted to the (M.TECH / M.B.A. / M.C.A.) programme after he/she fulfills all the admission requirements set by the Institute and after payment of the prescribed fees.

2.3 Candidates for admission to the first semester of the Master's Degree Programme shall be required to have passed an appropriate Degree Examination recognized by Hindustan University.

2.4 In all matters relating to admission to the (M.TECH / M.B.A. / M.C.A.). Programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.

2.5 If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

3. Structure of the programme

3.1 The programme of instruction will have the following structure

i) Core courses of Engineering / Technology / Management.

ii) Elective courses for specialization in areas of student's choice

3.2 The minimum durations of the programmes are as given below:

Program	No. of Semesters
M.Tech.(Full-Time)	4
M.Tech.(Part -Time)	6
M.B.A. (Full - Time)	4
M.B.A. (Part - Time)	6
M.C.A.(Full - Time)	6
M.C.A.(Part -Time)	8

Every (M.TECH / M.B.A. / M.C.A.) programme will have a curriculum and syllabi for the courses approved by the Academic Council.

3.3 Each course is normally assigned certain number of credits. The following norms will generally be followed in assigning credits for courses.

- One credit for each lecture hour per week per semester
- One credit for each tutorial hour per week per semester
- One credit for each laboratory practical of three hours per week per semester.
- One credit for 4 weeks of industrial training and
- One credit for 2 hours of project per week per semester.

3.4 For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below.

Program	Minimum prescribed credit range
M.Tech. (Full time / Part time)	75 - 85
M.B.A. (Full time / Part time)	85 - 95
M.C.A (Full time / Part time)	115 - 125

3.5 The medium of instruction, examination and the language of the project reports will be English.

4. Faculty Advisor

4.1 To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned Department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor.

5. Class Committee

5.1 A Class Committee consisting of the following will be constituted by the Head of the Department for each class:

(i) A Chairman, who is not teaching the class.

(ii) All subject teachers of the class.

(iii) Two students nominated by the department in consultation with the class.

The Class Committee will meet as often as necessary, but not less than three times during a semester.

The functions of the Class Committee will include:

(i) Addressing problems experienced by students in the classroom and the laboratories.

(ii) Analyzing the performance of the students of the class after each test and finding ways and means of addressing problems, if any.

(iii) During the meetings, the student members shall express the opinions and suggestions of the class students to improve the teaching / learning process.

6. Grading

6.1 A grading system as below will be adhered to.

Range of Marks	Letter Grade	Grade points
95-100	S	10
85 - 94	A	09
75- 84	B	08
65-74	C	07
55-64	D	06
50-54	E	05
< 50	U	00
	I (Incomplete)	–

6.2 GPA & CGPA

GPA is the ratio of the sum of the product of the number of credits C_i of course "i " and the grade points P_i earned for that course taken over all courses "i" registered by the student to the sum of Ci for all "i ". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, at any semester, considering all the courses enrolled from first semester onwards.

6.3 For the students with letter grade I in certain subjects, the same will not be included in the computation of GPA and CGPA until after those grades are converted to the regular grades.

6.4 Raw marks will be moderated by a moderation board appointed by the Vice-Chancellor of the University. The final marks will be graded using an absolute grading system. The Constitution and composition of the moderation board will be dealt with separately.

7. Registration and Enrollment

7.1 Except for the first semester, registration and enrollment will be done in the beginning of the semester as per the schedule announced by the University.

7.2 A student will be eligible for enrollment only if he/she satisfies regulation 10 (maximum duration of the programme) and will be permitted to enroll if (i) he/she has cleared all dues in the Institute, Hostel & Library up to the end of the previous semester and (ii) he/she is not

debarred from enrollment by a disciplinary action of the University.

7.3 Students are required to submit registration form duly filled in.

8. Registration requirement

8.1 **(i)** A Full time student shall not register for less than 16 credits or more than 26 credits in any given semester.

8.1 **(ii)** A part time student shall not register for less than 10 credits or more than 20 credits in any given semester.

8.2 If a student finds his/her load heavy in any semester, or for any other valid reason, he/she may withdraw from the courses within three weeks of the commencement of the semester with the written approval of his/her Faculty Advisor and HOD. However the student should ensure that the total number of credits registered for in any semester should enable him/her to earn the minimum number of credits per semester for the completed semesters.

9. Minimum requirement to continue the programme

9.1 For those students who have not earned the minimum required credit prescribed for that particular semester examination, a warning letter to the concerned student and also to his parents regarding the shortage of his credit will be sent by the HOD after the announcement of the results of the university examinations.

10. Maximum duration of the programme

The minimum and maximum period for the completion of various programs are given below.

Program	Min. No. of Semesters	Max. No. of Semesters
M.Tech (Full - time)	4	8
M.Tech (Part - time)	6	10
M.B.A. (Full Time)	4	8
M.B.A. (Part Time)	6	10
M.C.A. (Full - Time)	6	12
M.C.A (Part -Time)	8	14

11. Temporary discontinuation

11.1 A student may be permitted by the Director(academic) to discontinue temporarily from the programme for a semester or a longer period for reasons of ill health or other valid reasons. Normally a student will be permitted to discontinue from the programme only for a maximum duration of two semesters.

12. Discipline

12.1 Every student is required to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

12.2 Any act of indiscipline of a student reported to the Director (Academic) will be referred to a Discipline Committee so constituted. The Committee will enquire into the charges and decide on suitable punishment if the charges are substantiated. The committee will also authorize the Director(Academic) to recommend to the Vice-Chancellor the implementation of the decision. The student concerned may appeal to the Vice-Chancellor whose decision will be final. The Director (Academic) will report the action taken at the next meeting of the Council.

12.3 Ragging and harassment of women are strictly prohibited in the University campus and hostels.

13. Attendance

13.1 A student whose attendance is less than 75% is not eligible to appear for the end semester examination for that semester. The details of all students who have attendance less than 75% will be announced by the teacher in the class. These details will be sent to the concerned HODs and Director (Academic).

13.2 Those who have less than 75% attendance will be considered for condonation of shortage of attendance. However a condonation of 10% in attendance will be given on medical reasons. Application for condonation recommended by the Faculty Advisor, concerned faculty member and the HOD is to be submitted to the Director (Academic) who, depending on the merits of the case, may permit the student to appear for the end semester examination. A student will be eligible for this concession at most in two semesters during the entire degree programme. Application for medical leave, supported by medical certificate with endorsement by a Registered Medical Officer, should reach the HOD within seven days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier.

13.3 As an incentive to those students who are involved in extra curricular activities such as representing the University in Sports and Games, Cultural Festivals, and Technical Festivals, NCC/ NSS events, a relaxation of up to 10% attendance will be given subject to the condition that these students take prior approval from the officer-in-charge. All such applications should be recommended by the concerned HOD and forwarded to Director (Academic) within seven instructional days after the programme/activity.

14. Assessment Procedure

14.1 The Academic Council will decide from time to time the system of tests and examinations in each subject in each semester.

14.2 For each theory course, the assessment will be done on a continuous basis as follows:

Test / Exam	Weightage	Duration of Test Exam
First Periodical Test*	10%	2 Periods
Second Periodical Test*	10%	2 Periods
Model exam	20%	3 hours
Seminar/ Assignments/Quiz	20%	
End - semester examination	50%	3 Hours

*** Best out of the two tests will be considered.**

14.3 For practical courses, the assessment will be done by the subject teachers as below:

(i) Weekly assignment/Observation note book / lab records - weightage 60%.

(ii) End semester examination of 3 hours duration including viva - weightage 40%

15. Make up Examination/model examination

15.1 Students who miss the end-semester examinations / model examination for valid reasons are eligible for make-up examination /model examination. Those

who miss the end-semester examination / model examination should apply to the Head of the Department concerned within five days after he / she missed examination, giving reasons for absence.

15.2 Permission to appear for make-up examination / model exam will be given under exceptional circumstances such as admission to a hospital due to illness. Students should produce a medical certificate issued by a Registered Medical Practitioner certifying that he/she was admitted to hospital during the period of examination / model exam and the same should be duly endorsed by parent / guardian and also by a medical officer of the University within 5 days.

16. Project evaluation

16.1 For Project work, the assessment will be done on a continuous basis as follows:

Review / Examination	Weightage
First Review	10%
Second Review	20%
Third Review	20%
End semester Examination	50%

For end semester exam, the student will submit a Project Report in a format specified by the Director (Academic). The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end - semester examination will be conducted by a Committee constituted by the Controller of Examinations. This will include an external expert.

17. Declaration of results

17.1 A candidate who secures not less than 50% of total marks prescribed for a course with a minimum of 50% of the marks prescribed for the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

17.2 After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of PG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The minutes of the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/ Registrar.

17.3 If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end semester examination, he/she shall register and re-appear for the end semester examination during the following semester. However, the sessional marks secured by the candidate will be retained for all such attempts.

17.4 If a candidate fails to secure a pass in a course due to insufficient sessional marks though meeting the minimum requirements of the end semester examination, wishes to improve on his/ her sessional marks, he/she will have to register for the particular course and

attend the course with permission of the HOD concerned and the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

17.5 A candidate can apply for the revaluation of his/her end semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/Controller of Examinations through the Head of the Department. The Registrar/ Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

17.6 The weightage for internal marks in finalizing results and grades shall be waived off after completion of 5 semesters.

18. Grade Card

18.1 After results are declared, grade sheet will be issued to each student, which will contain the following details:

(i) Program and branch for which the student has enrolled.

(ii) Semester of registration.

(iii) List of courses registered during the semester and the grade scored.

(iv) Semester Grade Point Average (GPA)

(v) Cumulative Grade Point Average (CGPA).

19. Class / Division

19.1 Classification is based on CGPA and is as follows:

CGPA $\geq$ 8.0 : **First Class with distinction**

6.5 $\leq$ CGPA < 8.0 : **First Class**

5.0 $\leq$ CGPA < 6.5 : **Second Class.**

19.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance within the minimum duration of the programme.

(ii) The award of 'First Class' is further subject to the candidate becoming eligible to the award of the degree having passed the examination in all the courses within the below mentioned duration of the programme.

Program	No. of Semesters
M.Tech.(Full-Time)	5
M.Tech.(Part -Time)	7
M.B.A. (Full - Time)	5
M.B.A. (Part - Time)	7
M.C.A.(Full - Time)	7
M.C.A.(Part -Time)	9

(iii) The period of authorized discontinuation of the programme (vide clause 11.1) will not be counted for the purpose of the above classification.

20. Transfer of credits

20.1 Within the broad framework of these regulations, the Academic Council, based on the recommendation of the transfer of credits committee so constituted by the Chancellor may permit students to earn part of the credit requirement in other approved institutions of repute and status in the country or abroad.

21. Eligibility for the award of (M.TECH / M.B.A. / M.C.A.) Degree

21.1 A student will be declared to be eligible for the award of the (M.TECH / M.B.A. / M.C.A.). Degree if he/she has

i) registered and successfully credited all the core courses,

ii) successfully acquired the credits in the different categories as specified in the curriculum corresponding to the discipline (branch) of his/her study within the stipulated time,

iii) has no dues to all sections of the Institute including Hostels, and

iv) has no disciplinary action pending against him/her.

The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

22. Power to modify

22.1 Notwithstanding all that has been stated above, the Academic Council has the right to modify any of the above regulations from time to time subject to approval by the Board of Management.

HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

M.Tech. STRUCTURAL ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
Theory							
1	PMA 104	Applied Mathematics	3	1	0	4	4
2	PST 101	Experimental Methods and Model Analysis	3	1	0	4	4
3	PST 102	Matrix methods of structural analysis	3	1	0	4	4
4	PST 103	Theory of elasticity and plasticity	3	1	0	4	4
5	PST 104	Concrete Structures	3	1	0	4	4
6	PST 105	Design of Tall Structures	3	1	0	4	4
PRACTICAL							
7	PST 106	Structural Analysis Laboratory	0	0	4	2	4
		TOTAL				**26**	**28**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	PST 201	Structural Dynamics	3	1	0	4	4
2	PST 202	Steel Structures	3	1	0	4	4
3	PST 203	Finite Element Analysis	3	1	0	4	4
4	PST 204	Theory of Plates and Shells	3	1	0	4	4
5	-	Elective - I	3	0	0	3	3
6	-	Elective - II	3	0	0	3	3
PRACTICAL							
7	PST 205	Computing Laboratory	0	0	4	2	4
				Total		**24**	**26**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	-	Elective - III	3	0	0	3	3
2	-	Elective - IV	3	0	0	3	3
3	-	Elective - V	3	0	0	3	3
PRACTICAL							
4	PST 301	Practical Training (4 weeks during summer)	-	-	-	2	0
5	PST 302	Seminar	0	0	2	1	2
6	PST 303	Project Work- Phase I	0	0	12	6	12
TOTAL						**18**	**23**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
1	PST 401	Project Work - Phase II	0	0	24	12	24
TOTAL						**12**	**24**

LIST OF ELECTIVES FOR THIRD SEMESTER

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C	TCH
1.	PST 701	Soil Structure Interaction	3	0	0	3	3
2.	PST 702	Wind and Cyclone effects on Structures	3	0	0	3	3
3.	PST 703	CAAD for Structures	3	0	0	3	3
4.	PST 704	Design of Bridges	3	0	0	3	3
5.	PST 705	Design of Plates, Shells and Spatial Structures	3	0	0	3	3
6.	PST 706	Design of Steel Concrete Composite Structures	3	0	0	3	3
7.	PST 707	Design of Structures for Dynamic Loads	3	0	0	3	3
8.	PST 708	Industrial Structures	3	0	0	3	3
9.	PST 709	Maintenance and Rehabilitation of Structures	3	0	0	3	3
10.	PST 710	Optimization in Structural Design	3	0	0	3	3
11.	PST 711	Prestressed Concrete	3	0	0	3	3
12.	PST 712	Stability of Structures	3	0	0	3	3
13.	PST 713	Design of Substructures	3	0	0	3	3
14.	PST 714	Aseismic Design of Structures	3	0	0	3	3

TOTAL CREDITS = 80

HINDUSTAN UNIVERSITY
HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE
M.Tech. STRUCTURAL ENGINEERING

SEMESTER I

PMA 104 APPLIED MATHEMATICS

L	T	P	C
3	1	0	4

GOAL

The Course will help the students to understand the concepts and applications of applied mathematics in the field of structural engineering.

OBJECTIVES

The course should enable the students to

1. Understand the basic concepts of caluclus and its variations.
2. Learn about transform methods for various dimentional wave equations.
3. Gain the knowledge on elliptical equations.
4. Know the probablity functions on Random theory.
5. Learn about the basic concepts on Linear Functions.

OUTCOMES

The students should be able to:

1. Use the calculus principles in the field of structural engineering.
2. Find the solution for dimentional problem by using laplace concepts.
3. Implement the elliptical equations in the filed of structural engineering.
4. Interpolate structural datas by using probablity theories.
5. Explain the Linear function concepts in structural engieering.

UNIT I CALCULUS OF VARIATIONS **12**

Concept of variations and its properties - Euler's Equations - Functional dependent of first and higher order derivatives - Functional dependent on functions of several independent variables - Isoperimetric problems - Direct methods - Ritz and kantrovich methods

UNIT II TRANSFORM METHODS **12**

Laplace transform methods for one dimensional wave equations - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier Transform methods for one dimensional heat conductional problems in infinite and semi-infinite rod.

UNIT III ELLIPTIC EQUATIONS **12**

Laplace equation - Properties of Harmonic functions - Solutions of Laplace equation by means of Fourier transform in a half plane in an infinite strip and in a semi-infinite strip.

UNIT IV PROBABILITY AND RANDOM THEORY **12**

Probability and random variables and functions - Moments in one and two dimensions first and second order methods - Correlation and Regressions - Partial and multiple correlation.

UNIT V LINEAR **12**

Basic concepts - Graphical and Simplex method - Transportation problem - Assignment problem.

TOTAL: 60

TEXT BOOKS:

1. A.S. Gupta - Calculus of Variations with Applications; Prentice Hall of India (P) Pvt. Ltd., (New Delhi) - 6th print 2006.
2. Sankar Rao. K. - Introductions to Partial Differential Equations; Prentice Hall of India (P) Ltd (New Delhi) - 5th print 2004.
3. B.S. Grawal, Khanna Publisher New Delhi Higher Engineering Mathematics.
4. S.P. Gupta, Statistical Methods, Khanna Publihser New Delhi.
5. Hardy. A. Taha, Operation Research - Prentice Hall of India.

REFERENCES:

1. Jain. R.K, Iyangar. S.R.K. - Advanced Engineering Mathematics ; Narosa publications 2nd Edition 2006.
2. Gupta S.C., Kapoor V.K - Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11th print 2003.
3. Taha. H.A, Operations Research - An Introduction - Prentice Hall of India (P) Ltd (New Delhi) - 6th Edition 2002.
4. Gupta P.H, Hira. D.S, Operations Research, S. Chand and Co (New Delhi) - 5th Edition 2001.

PST 101 EXPERIMENTAL METHODS AND MODEL ANALYSIS

L	T	P	C
3	1	0	4

GOAL

The course will help the students to understand the concepts in strain measurement, Non-destructive testing and model analysis.

OBJECTIVES

The course should enable the student to :

1. Understand basic concepts in measurements.
2. Know about Strain gauge circuits.
3. Learn about Indicating and recording devices.
4. Gain Knowledge on non destructive testing techniques.
5. Learn about the laws of similitude and model testing.

OUTCOMES

The students will be able to:

1. Measure displacement, strain pressure, force, torque etc. using different types of strain gauges.
2. Sketch and explain strain gauge circuits.
3. Describe the various recording methods and data acquisition techniques.
4. Familiarise with non destructive testing techniques, Photoelasticity, Polariscope, Isoclinics, Isochromatics and methods of stress separation.
5. Explain the laws of similitude and model testing applications.

UNIT I BASIC CONCEPT IN MEASUREMENTS AND STRAIN GAUGES 9

Basic Concept in Measurements, Measurement of displacement, strain pressure, force, torque etc, Types of strain gauges (Mechanical, Electrical resistance, Acoustical etc.).

UNIT II STRAIN GAUGE CIRCUITS 9

Strain gauge circuits - The potentiometer and Wheatstone bridge - use of lead wires switches etc. Use of electrical resistance strain gauges in transducer applications.

UNIT III INDICATING AND RECORDING DEVICES 9

Indicating and recording devices - Static and dynamic data recording -Data (Digital and Analogue) acquisition and processing systems. Strain analysis methods - Rosette analysis. Static and dynamic testing techniques. Equipment for loading-Moire's techniques.

UNIT IV NON DESTRUCTIVE TESTING TECHNIQUES 9

Non destructive testing techniques. Photoelasticity - optics of photoelasticity - Polariscope - Isoclinics and Isochromatics - methods of stress separation.

UNIT V LAWS OF SIMILITUDE AND MODEL TESTING 9

Laws of similitude - model materials - model testing - testing large scale structures - holographic techniques

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOKS:

1. Dally J W and Riley W.F, Experimental stress Analysis, McGraw-Hill, Inc. New York, 1991.
2. Srinath L S et al, Experimental Stress Analysis, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1984.

REFERENCES:

1. Rangan C S et al., Instrumentation - Devices and Systems, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1983.
2. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996.

PST 102 MATRIX METHODS OF STRUCTURAL ANALYSIS

L	T	P	C
3	1	0	4

GOAL

To develop competency in analysis of structures using matrix methods.

OBJECTIVES

The course should enable the students to :

1. Know about the analysis of plane frames using displacement method.
2. Familiar with the analysis of plane frames using flexibility method.
3. Acquainted with the analysis of space trusses.
4. To get exposure to solve beam and plane frame problems using MAT lab software.
5. Exposure to substructure and static condensation procedures.

OUTCOMES

The students will be able to:

1. Solve rigid jointed and pin jointed plane frames using displacement method.
2. Find the member forces of plane frames using flexibility method.
3. Find the member forces of space trusses using displacement method.
4. Find the member forces of beam plane frames using the software.
5. Solve plane frame problems using substructures technique.

UNIT I INTRODUCTION AND DISPLACEMENT METHOD-2D ANALYSIS 9

Introduction to Matrix Methods - displacement formulation - analysis of continuous beams - co-ordinate - transformations - rigid and pin jointed plane - frames.

UNIT II FORCE METHOD 9

Matrix flexibility methods - general formulation - application to plane rigid frames - plane trusses.

UNIT III DISPLACEMENT METHOD - 3D ANALYSIS **9**

Displacement method for three dimensional Structure - Coordiante transformations - analysis of space trusses.

UNIT IV COMPUTERISATION **9**

Programming techniques - formulation of stiffness matrix - displacement - Beams and plane frames using MAT LAB.

UNIT V SPECIAL PROBLEMS **9**

Analysis of large structures - sub structuring static condensation procedure - Simple problems only.

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOK:

1. Madhujit Mukhopadhyay, Abdul Hamied Sheikh, Matrix and Finite Element Analyses of Structures, Anne Books, First Edition, 2004.
2. Structural Analysis - A Matrix Approach - G.S. Pandit & S.P. Gupta, Tata McGraw Hill

REFERENCES:

1. Damodar Maity, Computer Analysis of framed Structures, I.K. Interanational Publishing house Pvt. Ltd, 2007.
2. Matrix Analysis of Framed Structures - Jr. William Weaver & James M. Gere, CBS Publishers and Distributors, Delhi.

PST 103 THEORY OF ELASTICITY AND PLASTICITY

L	T	P	C
3	1	0	4

GOAL

To impart knowledge in analyzing stresses & strains, torsions of their walled sections, energy methods and solve problems in plastic design.

OBJECTIVES

The course should enable students to:

1. Understand the basic concepts of stresses & strains.
2. Introduce two dimensional state stresses.
3. Introduction torsional concepts.
4. Introduce the structural problems using energy principles.
5. Introduction to inelastic state of stress.

OUTCOMES

The students should be able to:

1. Solve simple in stress problems like stress, strain and compliance.
2. Relate the state of stress in difference Co-ordinate system.
3. Ability to understand how different sections behave when subjected to torsion.
4. Formulate structural problems based on energy methods.
5. Understanding of structural behaviour in the inelastic state.

UNIT I ANALYSIS OF STRESS AND STRAIN 9

Analysis of stress and strain, stress strain relationship, Generalized Hooke's law. Plane stress and plane strain.

UNIT II 2D PROBLEMS 9

Two dimensional problems in Cartesian and polar co-ordinates for simple problems

UNIT III TORSION 9

Torsion of non-circular section - methods of analysis - membrane analogy - torsion of thin rectangular section and hollow thin walled sections.

UNIT IV ENERGY METHODS 9

Energy methods - principle or virtual work - energy theorem - Rayleigh Ritz methods - Finite Difference method.

UNIT V INTRODUCTION TO PROBLEMS IN PLASTICITY 9

Physical assumption - criterion of yielding, yield surface, Flow rule (plastic stress strain relationship). Elastic plastic problems of beams in bending - plastic torsion.

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOKS:

1. Timoshenko, S. and Goodier T.N. "Theory of Elasticity", McGraw Hill Book Co., Newyork, II
2. Sadhu Singh, "Theory of Plasticity", Khanna Publishers, New Delhi 1998.

REFERENCES:

1. Dowling, N.E., Mechanical Behaviour of Materials: Engineering Methods of Deformation, Fracture and Fatigue, 2nd Edition, Prentice - Hall, 1999.
2. Bedford, A.M. and Liechti, K.M., Mechanics of Materials, Prentice Hall, 2001.
3. Popov, E "Mechanics of Materials", Prentice Hall Reprinted Pearson Education, 2003.

PST 104 CONCRETE STRUCTURES

L	T	P	C
3	1	0	4

GOAL

To achieve comprehensive knowledge in the design of RC elements & structures.

OBJECTIVES

The course should enable the students to :

1. Study the flexural resistance offered by RC beams.
2. Study the compression behaviour of slende columns.
3. Introduce the design concepts non conventional RC elements.
4. Introduced two dimensional behaviour of RC elements.
5. Introduce to in- elastic behaviour of concrete beams and frames.

OUTCOMES

The students should be able to :

1. Understand the codal procedure and design the RC beams.
2. Understand the compress behaviour of columns and be able to design it using codal provisions.
3. Design RC elements involving complex design principles.
4. Analyse & design flate slabs and plates.
5. Design and detail RC elements for ductility, durability and fire resistance.

UNIT I DESIGN OF BEAMS **9**

Behaviour of RCC beams under combined Shear Torsion and Bending-Modes of Failures-Inter action effects-Analysis and design of beams circular in plan and Spandrel beams-Design for Serviceability Limit states-Design calculation of deflections and crack width according to IS 456-2000

UNIT II DESIGN OF SLENDER COLUMNS **6**

Behaviour of slender RCC Columns- Failure modes and Interaction curves-Additional Moment method-Comparison of codal provisions- calculation of design moments for braced and unbraced columns-Principles of Moment magnification method-design of slender columns.

UNIT III DESIGN OF SPECIAL RC -ELEMENTS **12**

Design and detailing of Concrete braced and unbraced walls according to BIS code-Classification of shear walls, design principles, design of rectangular and flanged shear walls-Analysis of forces, Design and detailing of Corbels-Design and detailing of Deep beams- and Approximate analysis and design of Grid floors.

UNIT IV DESIGN OF FLAT SLABS AND FLAT PLATES **9**

Yield line theory of slabs - Hillerberg method of design of slabs- Design of Flat slabs and flat plates according to BIS method-Shear in Flat Slabs and Flat Plates

UNIT V IN-ELASTIC BEHAVIOUR OF CONCRETE BEAMS AND FRAMES **9**

Inelastic behaviour of concrete beams-moment-rotation curves-moment redistribution-Bakers method of analysis and design-Design of cast-in-situ joints in frames. Detailing requirements for ductility, durability and fire resistance

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOKS :

1. Varghese, P.C. "Advanced Reinforced Concrete Design", Prentice Hall of India, (2002).
2. Shah V.L., & Karve S.R. "Limit state theory and Design of Reinforced Concrete", Structures Publications, Pune (2003)
3. Krishna Raju, N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributers, (1986)
4. Sinha.S.N., "Reinforced Concrete Design", Tata-McGraw-Hill (1996).

REFERENCES :

1. Purushothaman, P, Reinforced Concrete Structure Structural Elements: Behaviour Analysis and Design, Tata McGraw-Hill, (1986).
2. Varghese, P.C. "Limit State Design of Reinforced Concrete", Prentice Hall of India, (2002).
3. Ramchandra & Virendra Gehlot., "Elements of Limit State Design of Concrete Structures" Scientific Publishers (India), (2004)
4. Arthur H.Nilson "Design of Concrete Structures", Tata McGraw-Hill,(2003)

PST 105 DESIGN OF TALL STRUCTURES

L	T	P	C
3	1	0	4

GOAL

To impart overall knowledge about the elements and systems with planning, analysis and design involved in Tall structures.

OBJECTIVES

The course should enable the students to:

1. Understand the various aspects of planning of Tall buildings.
2. Know the different types of loads considered in the analysis of Tall structures.
3. Impart knowledge about the stability analysis of various structural systems.
4. Introduce various structural systems used for the construction of Tall buildings.
5. Understand the concepts of approximate analysis of Structural system.

OUTCOMES

The students will be able to:

1. Describe the various structural systems used in the construction of Tall structures.
2. Capable of analyzing the tall structures using the computer based methods and approximate method of analysis.
3. Execute stability analysis, overall buckling analysis of frames, Analysis for various secondary effects -such as Creep, Shrinkage and Temperature.
4. Carry out approximate analysis of framed and shear wall structures.
5. Describe High Rise Suspension system and Deep Beam system.

UNIT I DESIGN CRITERIA **6**

Design Philosophy, Materials - Modern concepts - High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete.

UNIT II LOADING **8**

Gravity Loading - Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading - Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading - Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads,

UNIT III BEHAVIOUR OF STRUCTURAL SYSTEMS **9**

Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, In filled frames, Shear walls, Coupled Shear walls, Wall - Frames, Tubular, Outrigger braced, Hybrid systems.

UNIT IV ANALYSIS AND DESIGN **13**

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

UNIT V STABILITY ANALYSIS **9**

Overall buckling analysis of frames, wall - frames, Approximate methods, Second order effect of gravity loading, P - Delta Effects, Simultaneous first order and P-Delta analysis, Translational instability, Torsional Instability, Out of plumb effects, Effect of stiffness of members and foundation rotation in stability of structures.

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOKS:

1. Bryan Stafford Smith and Alex Coull, "Tall Building Structures", Analysis and Design, John Wiley and Sons, Inc., 1991.
2. Taranath B.S, "Structural Analysis and Design of Tall Buildings", McGraw-Hill, 1988.

REFERENCES:

1. LinT.Y. and Burry D.Stotes, "Structural Concepts and Systems for Architects and Engineers", John Wiley, 1994.
2. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.

PST 106 STRUCTURAL ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

GOAL

To enable the students to analyse the beams, frames and trusses using the programming technique-MATLAB

OBJECTIVE

To get exposed to the usage of MATLAB software in the analysis of structures.

OUTCOME

The students will be able to formulate the stiffness matrix and displacement of the beams, frames and trusses using the MATLAB software.

LIST OF EXPERIMENTS

1. ANALYSIS OF BEAMS **15**

Programming techniques - formulation of stiffness matrix - displacement - Beams

2. ANALYSIS OF PLANE FRAMES **15**

Programming techniques - formulation of stiffness matrix - displacement - plane frames

3. ANALYSIS OF TRUSSES **15**

Programming techniques - formulation of stiffness matrix - displacement - trusses

SOFTWARE USED :

MAT Lab. software

Total : 45

SEMESTER II

PST 201 STRUCTURAL DYNAMICS

L	T	P	C
3	1	0	4

GOAL

To impart rudiments of theory of vibrations necessary to understand and analyze the dynamic forces caused by earthquakes and structures.

OBJECTIVES

The course should enable the students to :

1. Introduction to free vibration of SDOF sytems.
2. Understand the principles involved in forced vibration single degree of freedom system.
3. Get exposure to multi degree of freedom system.
4. Exposure to numerical methods for finding the response of structures.
5. Know about dynamics of distributed parameter systems.

OUTCOMES

The students will be able to:

1. Solve simple problems in the dynamic framework.
2. Calculate the respond structures of subjected to harmonic loading and general type of forcing function.
3. Ability to solve the problems frequency domain.
4. Ability to solve problems using numerical methods in the time domain.
5. Solve free vibration and forced vibration problems using continuous distributed system.

UNIT I FREE VIBRATION OF SINGLE DEGREE OF FREEDOM SYSTEMS 9

Difference between static and dynamic loading - Nature of dynamic loads - Wind, earth quake and impact loads - Formulation of equation of motion - D'Alembert's principles - Free undamped vibration - Free Damped vibration - Logarithmic decrement.

UNIT II FORCED VIBRATION OF SINGLE DEGREE OF FREEDOM SYSTEM 9

Response of undamped and damped systems to harmonic loading - Rotating unbalance - reciprocating unbalance - Vibration isolation and transmissibility - Response of the SDOF system to a general type of forcing function - Dynamic load factor and response spectrum - Support motion - Response of SDOF systems related to earthquakes.

UNIT III FREE AND FORCED VIBRATION OF MULTIPLE DEGREES OF FREEDOM SYSTEM 9

Equation of motion of MDF systems - Free undamped vibration analysis - Orthogonality relationship

- Eigenvalue problem - Absolute displacement of free vibration of MDOF systems - Mode superposition method - Response of MDF systems to support motion.

UNIT IV NUMERICAL METHODS APPLIED TO SINGLE DEGREE OF FREEDOM SYSTEMS 9

Direct integration techniques - Finite difference method - Linear acceleration method - Newmark's - method - Numerical evaluation of Duhamel's Integral.

UNIT V CONTINUOUS SYSTEMS 9

Dynamics of distributed parameter systems - Free Flexural Vibration of Beams - Forced Vibration of Flexural Member.

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOKS :

1. Madhujit Mukhopadhyay, Structural Dynamics - Vibrations & Systems, Ane's Student Edition, Ane Books India.
2. Mario Paz,William Leigh, " Structural Dynamics Theory and Computation", Springer - 2004.

REFERENCES:

1. S.R.Damodarasamy, S.Kavitha "Basics of Structural dynamics and Aseismic Design", PHI Learning Private Limited., 2009.
2. Clough R.W. and Penzien, J., Dynamics of Structures, McGraw-Hill, 1990
3. Anil K.Chopra, "Dynamics of Structures Theory and Applications to Earthquake Engineering" Pearson Education., 2003.

PST 202 STEEL STRUCTURES

L	T	P	C
3	1	0	4

GOAL

To introduce the students to limit state design of structural components as per current codal provisions.

OBJECTIVES

The course should enable the students to :

1. Introduce the design concepts predominantly wind loaded steel structures.
2. Introduce the behaviour of structural steel connection.
3. Know about concepts and the design lights Gauge sections (LGS)
4. Familiar with the analysis and design concepts of special structures such as tank and chimney.
5. Throw light on the advanced design philosophy of plastic design.

OUTCOMES

The students will be able to:

1. Develop competency in the design of industrial structures.
2. Ability to design steel connections with respect to difference stiffness requirements.
3. Compelency in designing the thin walled structures considering post buckling strength.
4. Design special structures such as tank and chimney
5. Capable of applying the advanced design philosophy in real time complicated structures and research oriented activities.

UNIT I ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS 9

Review of loads on structures-Dead, Live, wind and Seismic loads as per National standard - Design of Purlins, louver rails, gable column and Gable wind girder-Analysis and design of Gable frames.

UNIT II BEHAVIOUR AND DESIGN OF CONNECTIONS 9

Connection behaviour -Design requirements of Bolted and welded connections- unsiffened and stiffened seat connections -framed connections- Connections for force and moment transmission-tee stub connections - principles of semi rigid connections

UNIT III ANALYSIS AND DESIGN OF COLD-FORMED STEEL STRUCTURES 9

Types of cross sections-concepts of local buckling, and Effective width-Design of compression and tension members,- concepts of lateral buckling -Design of Beams, deflections of beams and design of beam webs.- Combined stresses and connections-Empirical design of Z-purlins with lips and wall studs.

UNIT IV ANALYSIS AND DESIGN OF SPECIAL STRUCTURES 9

Analysis and design of Steel Water Tanks- Cylindrical and pressed steel tanks -Design of self supporting Chimney (lined and unlined) - Stresses due to wind and earthquake forces-Design of foundations along with loads calculation.

UNIT V ADVANCED DESIGN PHILOSOPHIES 9

Concepts of Plastic design - Probabilistic basis of Load and Resistance Factors-LRFD -Limit State Design -Ultimate and serviceability limit states-Limit State Design of Axially loaded members - Design of beams.

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOK:

1. N. Subramanian, "Design of Steel Structures", Oxford University Press, USA, 2008.
2. IS.800 -2007
3. IS.801-1975

REFERENCES:

1. Dr.Ramachandra, Virendra Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, New Delhi, 2010
2. William T. Segui "LFRD Steel Design" PWS Publishing
3. Teaching Resource for Structural Steel Design, INSDAG. Kolkotta (2001)
4. J.Rhodes, "Design of Cold-Formed Steel Members", Elsevier Science Publishers (1991)

PST 203 FINITE ELEMENT ANALYSIS

L	T	P	C
3	1	0	4

GOAL

To introduce the students to the basis and fundamentals of Finite Element Method which they require in their profession for the computer -aided analysis of structures, machines and components.

OBJECTIVES

The course should enable students to:

1. Understand the concepts of discrete and continuum structures and numerical approximation methods like Ritz and Weighted Residual Methods.
2. Implementing the theory of methods in practice.
3. Learn the procedures for preprocessing, solution and post processing using one and two dimensional elements as examples.
4. To learn the need and use of higher order elements using iso-parametric mapping and numerical integration.
5. To learn the use of FEM for thermal analysis problems involving conduction and convection.

OUTCOMES

The Students will develop skills :

1. To develop a Finite Element Model of a structure met with in professional practice.
2. To carry out the procedures for obtaining stresses and displacements under given loading condition.
3. Assess the accuracy of solution obtained and carry out further refinement when needed.
4. Be in a position to appreciate intelligently the output from Package Programs.
5. Use FEM in other engineering disciplines.

UNIT I MATHEMATICAL FOUNDATIONS OF FINITE ELEMENT METHOD 9

Historical background - Influence of Computer Development on Computational Mechanics - Approximate Solution - Variational Method - Principle of Minimum Potential Energy - Ritz Method - Weighted Residual Techniques - Galerkin Method - Principles Illustrated through bar and beam problems .

UNIT II THEORY OF FINITE ELEMENT METHOD **9**

Discretization of Continuum Structures - Characterization of 1D, 2D and 3D problems based on Aspect ratio - Strain - displacement, Stress-strain and equilibrium equations - Constitutive Matrix - Concept of a finite element - Shape Function - Derivation of element stiffness equation - Illustration through application to bar, beam and truss problems - Temperature effects - p and h mesh refinement - Adaptive refinement.

UNIT III TWO AND THREE DIMENSIONAL SIMPLEX ELEMENTS **9**

Plane Stress, Plane Strain and Axi-symmetric Problems - CST element - Derivation of Shape Function - Various loading conditions like body force, surface force and temperature change - Tetrahedron element - Introduction to Plate and Shell elements.

UNIT IV HIGHER ORDER ELEMENTS AND ISOPARAMETRIC MAPPING **9**

Need for higher order elements - Generation of shape functions - Lagrange interpolation - QUAD4, QUAD8 and QUAD9 elements for 2D problems - BRICK8 element for 3D problems - Isoperimetric Mapping - Gauss quadrature.

UNIT V THERMAL ANALYSIS PROBLEMS **9**

Laws of heat conduction and convection - Poisson differential equation in 1D and 2D - Thermal stiffness matrix and load vector - Problems involving conduction and convection in bars, fins, walls and solids.

TUTORIAL: 15

L = 45, T = 15, TOTAL = 60

TEXT BOOKS :

1. Chandraputla T.R. and Belegundu A.D., Introduction to Finite Element Analysis in Engineering. Pearson Education 2002 , 3rd edition.
2. Reddy J.N. An Introduction to Finite Element Method. McGraw - Hill International student Edition.

REFERENCES:

1. O.C. Zienkiewicz and R.L. Taylor. The Finite Element Method. Vol.I. Butterworth Heinemann, 5th Edition, 2000.
2. Robert D. Cook, David S. Malkus and Michael E. Plesha. Concepts and Application of Finite Element Analysis. 4th edition, Wiley, 2003.

PST 204 THEORY OF PLATES AND SHELLS

L	T	P	C
3	1	0	4

GOAL

To get knowledge in Analysis and Theory of Plates Shells

OBJECTIVES

The course should enable the students to :

1. Understand the bending of thin plates with small deflection.
2. Understand the concept of bending of circular plates.
3. Get familiar with the analysis and design concepts of laterally loaded rectangular plates.
4. Get acquainted with the Finite difference method and Finite element method for analysis of plates.
5. Be familiar with the Analysis and design of circular and cylindrical shells.

OUTCOMES

The students will be able to:

1. Describe Bending of thin plates.
2. Analyse the uniformaly loaded circular plates.
3. Analyse lateral loaded rectangular plates.
4. Analyse the plates using Finite difference method and finite element method.
5. Design the circular and cylindrical shells.

UNIT I INTRODUCTION **9**

Assumptions in the theory of thin plates - Pure bending of Plates - Relations between bending moments and curvature - Pure bending of rectangular plates- simply supported edges - Strain energy in pure bending of plates in Cartesian and polar co-ordinates - Limitations.

UNIT II LATERALLY LOADED CIRCULAR PLATES **9**

Differential of equilibrium - Uniformly loaded circular plates with simply supported and fixed boundary conditions - Annular plate with uniform moment and shear force along the boundaries.

UNIT III LATERALLY LOADED RECTANGULAR PLATES **9**

Differential equation of plates - Boundary conditions Navier solution for simply supported plates subjected to uniformly distributed load and point load - Levy's method of solution for plates having two opposite edges simply supported with various symmetrical boundary conditions along the other two edges loaded with u. d. l. - Simply supported plates with moments distributed along the edges - Large Deflection theory.

UNIT IV FINITE DIFFEREENCE METHOD AND FINITE ELEMENT METHOD 9

Finite difference Method and Finite element method for solution of plate bending problems.

UNIT V ANALYSIS AND DESIGN OF SHELLS 9

Geometry of shells- Classification of shells- membrane theory of circular and cylindrical shells - Detailed analysis and design of cylindrical shells - Detailing of reinforcement in shells, edge beams and transfer beam.

TUTORIAL : 15

L = 45, T = 15, TOTAL = 60

TEXT BOOKS:

1. S.P Timoshenko and S.W Krieger, Theory of Plates and Shells, McGraw Hill, 1989.
2. Ramasamy, G.S. Design and Construction of Concrete Shell Roofs, CBS Publishers, 1986.

REFERENCES:

1. R. Szilard, Theory and Analysis of Plates -Classical Numerical Methods', Prentice Hall inc, 1974.
2. P.L Gould, Analysis of Shells and Plates, Springer-Verlag, New York, 1988

PST 205 COMPUTER PROGRAMMING LABORATORY
(Common to all branches)

L	T	P	C
0	0	4	2

GOAL

This course helps the students to analyze linear, nonlinear and dynamic analysis of beams, columns and frames using software.

OBJECTIVE

The course should enable the students to:

1. Understand elastic behaviour of Beams, columns and Frames.
2. Comprehend Inelastic behaviour of Beams, columns and Frames.
3. Be trained on Modal analysis of Beams, columns, frames

OUTCOMES

The students should be able to:

1. Explain the elastic behaviour in Structural systems like Beams, columns, frames.
2. Bring out the Inelastic behaviour of Structural systems Beams, columns, frames.
3. Predict the outcome of dynamic modal analysis of Beams, columns, frames in structural systems

LIST OF EXPERIMENTS:

1. LINEAR ANALYSIS **15**

Elastic behaviour of Structural systems - Beams, columns, frames.

2. NON-LINEAR ANALYSIS **15**

Inelastic behaviour of Structural systems - Beams, columns, frames.

3. DYNAMIC ANALYSIS **15**

Modal analysis of structural systems - Beams, columns, frames

Softwares required

1. STAAD-PRO
2. SAP 2000 - Software

Total : 45

ELECTIVES

PST 701 SOIL STRUCTURE INTERACTION

L	T	P	C
3	0	0	3

GOAL

To make the student understand the importance and significance of soil structure interaction and incorporate this in the design of structures to achieve both safety and economy.

OBJECTIVES

The course should enable the students to:

1. Understand the mechanism of soils, their interactive behaviour and analysis using the soil interaction models.
2. Get a basic knowledge of beams on elastic foundation
3. Understand the concept of Winkler model for soil-structure interaction analysis and analyse the soil as plates on elastic medium.
4. Get a basic understanding of the elastic analysis of piles, piles groups and the settlement analysis.
5. Get introduced to the load deflection prediction for laterally loaded piles, sub grade reaction, pile raft system and influence charts.

OUTCOMES

The students will be able to:

1. Gain knowledge about the soils, foundation interaction and analyse using the various soil models interaction, models.

2. Gain knowledge of beams on elastic foundation.
3. Identify the appropriate soil model for analysis.
4. Evaluate the settlement and load distribution for single piles and pile groups.
5. Analyse the load deflection of laterally loaded piles, subgrade reaction and pile raft system using influence charts.

UNIT I SOIL-FOUNDATION INTERACTION 9

Introduction to soil-foundation interaction problems - Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, Soil response models, Winkler, Elastic continuum, two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour.

UNIT II BEAM ON ELASTIC FOUNDATION- SOIL MODELS 9

Infinite beam, two parameters, Isotropic elastic half-space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

UNIT III PLATE ON ELASTIC MEDIUM 9

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, Simple solutions.

UNIT IV ELASTIC ANALYSIS OF PILE 9

Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

UNIT V LATERALLY LOADED PILE 9

Load deflection prediction for laterally loaded piles, Sub grade reaction and elastic analysis, Interaction analysis, Pile raft system, Solutions through influence charts

TOTAL = 45

TEXT BOOKS :

1. Poulos, H.G., and Davis, E.H., "Pile Foundation Analysis and Design", John Wiley, 1980
2. Scott, R.F., "Foundation Analysis", Prentice Hall, 1981

REFERENCES:

1. Selvadurai, A.P.S., "Elastic Analysis of Soil Foundation Interaction", Elsevier, 1979
2. "Structure-Soil Interaction - State of Art Report", Institution of Structural Engineers, 1978.
3. ACI 336, "Suggested Analysis and Design Procedures for combined footings and Mats", American Concrete Institute, Delhi, 1988

PST 702 WIND AND CYCLONE EFFECTS ON STRUCTURES

L	T	P	C
3	0	0	3

GOAL

To posses the students with knowledge about the force generated on structure due to normal wind and gusts.

OBJECTIVES

The course should enable the students to :

1. Understand the basic concepts of wind generation and flow.
2. Get exposure to wind tunnel experiments.
3. Understand the response of different type of structures to wind pressure.
4. Understand the codal provisions for the safe design of high rise structures.
5. Study the design concepts of towers and roof trusses.

OUTCOMES

The students will be able to:

1. Analyse the structure for different wind load condition.
2. Describe how the structural models can be tested in the wind tunnel and its uses.
3. Design the chimneys, towers and bridges
4. Design the structure for the given wind force condition as per the codal provisions.
5. Design towers and roof trusses for wind loading.

UNIT I INTRODUCTION **9**

Introduction, Spectral studies, Gust factor, Wind velocity, Methods of measurements, variation of speed with height, shape factor, aspect ratio, drag effects.

UNIT II WIND TUNNEL STUDIES **9**

Wind Tunnel Studies, Types of tunnels, Modeling requirements, Interpretation of results, Aero-elastic models.

UNIT III WIND EFFECT **9**

Wind on structures, Rigid structures, Flexible structures, Static and Dynamic effects, Tall buildings, chimneys.

UNIT IV DESIGN PRINCIPLES **9**

Application to design, IS 875 code method, Buildings, Chimneys, Roofs, Shelters.

UNIT V CYCLONE AND DESIGN **9**

Cyclone effect on structures, cladding design, window glass design.

TOTAL = 45

TEXT BOOKS:

1. Cook.N.J., The Designer's Guide to Wind Loading of Building Structures, Butterworths, 1989.
2. Kolousek., et.al. Wind Effects on Civil Engineering Structures, Elsevier Publications, 1984.

REFERENCES:

1. Peter Sachs, Wind Forces in Engineering, Pergamon Press, New York, 1972.
2. Lawson T.V., Wind Effects on Building Vol. I and II, Applied Science Publishers, London, 1980.

PST 703 CAAD FOR STRUCTURES

L	T	P	C
3	0	0	3

GOAL

To introduce the students to acquire knowledge of computer aided structural analysis, design / detailing of steel and RC structural elements, project scheduling and also the principles of neural network.

OBJECTIVES

The course should enable the students to:

1. Study the basics of 2-D drafting, Modeling of curves and Solid modeling.
2. Understand the Computer methods of structural analysis, Finite Element programming.
3. Study the Computer aided structural design of steel and RC elements.
4. Understand the Linear programming, Post-optimality and Project scheduling.
5. Study about the Artificial Intelligence based on the Architecture and applications.

OUTCOMES

The students will be able to:

1. Gain knowledge about the Graphic primitives and Drafting softwares.
2. Analyse the structure using Finite Element programming by application process.
3. Design the structure with Detailed drawing and Billing of materials.
4. Gain knowledge about Simplex algorithm, Project scheduling using CPM and PERT applications and Genetic algorithm.
5. Gain knowledge based on their expert systems, applications of KBES and Principles of neural network.

UNIT I COMPUTER GRAPHICS **9**

Graphic primitives - Transformations - Basics of 2-D drafting - Modeling of curves and surfaces - Solid modeling - Graphic standards - Drafting software packages and usage.

UNIT II STRUCTURAL ANALYSIS **9**

Computer methods of structural analysis - Finite Element programming - Analysis through application packages.

UNIT III STRUCTURAL DESIGN **9**

Computer aided design of steel and RC Structural elements - Detailed drawing - Bill of materials.

UNIT IV OPTIMIZATION **9**

Linear programming - Simplex algorithm - Post-optimality analysis - Project scheduling - CPM and PERT applications Genetic algorithm and applications.

UNIT V ARTIFICIAL INTELLIGENCE **9**

Introduction - Heuristic search - knowledge based expert systems - Architecture and applications of KBES - Expert system shells - Principles of neural network.

TOTAL : 45

TEXT BOOKS :

1. C.S. Krishnamoorthy and S.Rajeev, Computer Aided Design, Narosa Publishing House, New Delhi, 1991.
2. H.B. Harrison, Structural Analysis and Design Vol. I & II, Pergamon Press, 1991 E.Hinton and D.R.J.Owen, Finite Element Programming, Academic Press 1977.

REFERENCES:

1. Billy E.Gillet, Introduction to Operations Research, A computer oriented algorithmic approach, Tata McGraw-Hill 1982.
2. Richard Forsyth (Ed.), Expert System Principles and Case studies - Chapman & Hall.

PST 704 DESIGN OF BRIDGES

L	T	P	C
3	0	0	3

GOAL

To introduce the students to basic theory and concepts of design of steel, reinforced concrete and pre stressed concrete bridge design for IRC loading conditions.

OBJECTIVES

The course should enable the students to :

1. Understand the design concepts of through type and deck type steel highway bridges.
2. Be familiar with the design concepts of Pratt type truss girder highway bridges and plate girder railway bridges.
3. Be acquainted with the design concepts of reinforced concrete slab bridges.
4. Study the design concepts of reinforced concrete girder bridges.
5. Be acquainted with the design techniques involved in prestressed concrete bridges.

OUTCOMES

The students will be able to:

1. Design through type and deck type steel highway bridges for IRC loading.
2. Design the components of pratt type trusses girder and the components of plate girder including wind effects.
3. Design reinforced concrete bridges for IRC loading.
4. Design reinforced concrete tee beam bridges and balanced cantilever bridges.
5. Design the components of the prestressed concrete bridges such as girder section, end block etc.

UNIT I INTRODUCTION **9**

Classification, investigations and planning, choice of type, I.R.C.specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.

UNIT II SHORT SPAN BRIDGES **9**

Load distribution theories, analysis and design of slab culverts,T beam and slab bridges. Design of panel and cantilever for IRC loading.

UNIT III LONG SPAN GIRDER BRIDGES **9**

Design principles of continuous bridges, box girder bridges, balanced cantilever bridges - Bearings, Footings, Drilled shaft foundations and Caissons for bridges.

UNIT IV DESIGN OF PRESTRESSED CONCRETE BRIDGES **9**

Design of prestressed concrete bridges - Preliminary dimensions - Flexural and torsional parameters - Courbon's theory - Distribution coefficient by exact analysis - Design of girder section - Maximum and minimum prestressing forces - Eccentricity - Live load and dead load shear forces - cable zone in girder - Check for stresses at various sections - Check for diagonal tension - Diaphragms - End block - Short term and long term deflection.

UNIT V DESIGN OF PLATE GIRDER BRIDGES **9**

Design of plate girder railway bridges for railway loading - - Wind effects - Design of web and flange plates - Vertical and horizontal stiffeners.

TOTAL = 45

TEXT BOOK :

1. Krishnaraju, N., "Design of Bridges", Oxford and IBH Publishing Co., Bombay, Calcutta, New Delhi, 1988

REFERENCES:

1. Raina V.K. "Concrete Bridge Practice", Tata McGraw-Hill Publishing Company, New Delhi, 1991.
2. Bakht, B. and Jaegar, L.G., "Bridge Analysis Simplified", McGraw-Hill, 1985.
3. Ponnuswamy, S., "Bridge Engineering", Tata McGraw-Hill, 1989
4. Taylor, F.W., Thomson, S.E., and Smulski E., "Reinforced Concrete Bridges", John Wiley and Sons, New York, 1955.
6. Edwin H.Gaylord Jr., Charles N.Gaylord, James, E., Stallmeyer "Design of Steel Structures" McGraw-Hill International Editions, 1992.

PST 705 DESIGN OF PLATES, SHELLS AND SPATIAL STRUCTURES

L	T	P	C
3	0	0	3

GOAL

To get knowledge in Analysis and Design of Plates, Shells and space structures.

OBJECTIVE

The course should enable the students to :

1. Know about bending of their plates with small deflection.
2. To understand the design concepts of folded plates.
3. Get familiar with the analysis and design concepts of shell structures.
4. Get acquainted with the principles of design philosophy of space frames.
5. Know about Analysis of space frames with FQMEX Algebra.

OUTCOMES

The students will be able to:

1. Describe Bending of rectangular and circular plates.
2. To design folded plates.
3. Design cylindrical and circular shells.
4. Describe the design concepts of space frames.
5. Design space frames.

UNIT I THIN PLATES WITH SMALL DEFLECTION 9

Equation of equilibrium and deformation of plates - Bending of rectangular plates and circular plates. Navier's solution and Levy's method.

UNIT II ANALYSIS OF PLATES AND FOLDED PLATES 9

Energy method, finite difference and finite element methods for solution of plate bending problems. Principles of design of folded plates

UNIT III ANALYSIS AND DESIGN OF SHELLS 9

Geometry of shells - Classification of Shells - membrane theory of circular and cylindrical shells - Detailed Analysis and design of cylindrical shells - Detailing of Reinforcement in shells, edge beams and transfer beam

UNIT IV DESIGN OF SPACE FRAMES 9

Space frames - configuration - types of nodes - general principles of design Philosophy - Behaviour.

UNIT V ANALYSIS AND DESIGN OF SPACE FRAMES 9

Analysis of space frames - Formex Algebra, FOR MAIN - detailed design of space frames.

TOTAL = 45

TEXT BOOKS :

1. P.C.Varghese, Design of Reinforced Concrete Shells and Folded Plates,2010.
2. Ramasamy, G.S. Design and Construction of Concrete shells roofs, CBS Publishers, 1986.

REFERENCES:

1. Principles of space structures by Dr.N. Subramanian - 1999, Wheeler Publishing Co.
2. Proceedings of International Conference on Space structures, Anna University, November 1997.
3. Szllard, R. Theory of Analysis of Plates, Prentice Hall Inc.

PST 706 DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES

L	T	P	C
3	0	0	3

GOAL

To make the students to understand the principles involved in the analysis and design of steel concrete composite structures.

OBJECTIVES

The course should enable the students to :

1. Understand the concepts of limit state design of steel concrete composite structures.
2. Get exposure in the design concepts of steel concrete composite beams.
3. Familiarize with the design concepts of steel concrete composite trusses and columns.
4. Understand the design concepts of steel- concrete composite box girder bridges.
5. Know about the seismic behavior of composite structures.

OUTCOMES

The students will be able to:

1. Describe the principles involved in the limit state design of steel concrete composite structures.
2. Design the steel concrete composite beam with deck slabs.
3. Design the steel concrete composite columns.
4. Design the composite box girders.
5. Describe the seismic behavior of composite structures.

UNIT I INTRODUCTION **9**

Review of Limit State Design of steel columns and beams - Introduction to steel concrete composite structures - concepts and Theory - Typical shear connectors and interaction with concrete - Tests for strength of shear connections.

UNIT II DESIGN OF COMPOSITE BEAMS **9**

Ultimate behaviour of simply supported and continuous steel - concrete composite beams with solid deck slabs and profiled deck slabs.

UNIT III DESIGN OF COMPOSITE TRUSSES AND COLUMNS **9**

Behaviour and design of steel concrete composite Trusses - Shear connection details - Design of Steel concrete columns.

UNIT IV COMPOSITE BOX GRIDER BRIDGES **9**

Introduction to behaviour of box girder bridges - Design concepts.

UNIT V GENERAL **9**

Introduction to steel concrete sandwich construction - Seismic behavior of composite structures - case studies on steel-concrete composite construction in buildings.

TOTAL = 45

TEXT BOOK :

1. Johnson R.P., Composite Structures of Steel and Concrete, Blackwell Scientific Publications (Second Edition), UK, 1994.

REFERENCES:

1. "Teaching Resources for Structural Steel Design - Vol. I & II", INSDAG, Kolkatta.
2. Appropriate IS, British and Euro Codes.

PST 707 DESIGN OF STRUCTURES FOR DYNAMIC LOADS

L	T	P	C
3	0	0	3

GOAL

To introduce to the student the phenomena of Dynamic Load due to Earthquakes, Blast, Impact, Wind. And the process, measurements and the factors that affects the design of structures.

OBJECTIVES

The course should enable the students to :

1. Throw light on the Dynamic load behavior of SDOF, MDOF, and continuum system. Ductility and its importance
2. Have knowledge about the Design of various structural elements for earthquake loading according to BIS codes of practice.
3. Be familiar with design of building for blast and impact loading as per BIS codes of practice.
4. Understand the basics of wind speed, wind load and, design concepts of structures such as tall building, stacks and chimney for wind load.
5. Know the concepts energy absorbstion capacity, ductility, passive and active vibration control

OUTCOMES

The students will be able to:

1. Gain knowledge on the effect of dynamic load on different types of structure.
2. To gain knowledge on the behavior of framed, braced frames and shear wall buildings for seismic load, Design and detail the structures using the codal provisions
3. Design building for blast and impact loading as per BIS codes of practice.

4. Calculate the design wind speed and wind load with respect to appropriate pressure coefficient and design building for that wind load according to BIS standard.

5. Do duct ail detailing of the structure. And able to determine the suitable vibration control technique.

UNIT I INTRODUCTION **9**

Factors affecting design against dynamic loads - Behaviour of concrete, steel, masonry and soil under impact and cyclic loads - Recap of Structural dynamics with reference to SDOF, MDOF and continuum systems - Ductility and its importance.

UNIT II DESIGN AGAINST EARTHQUAKES **9**

Earthquake characterization - Response spectra - seismic co-effcient and response spectra methods of estimating loads - Response of framed, braced frames and shear wall buildings - Design as per BIS codes of practice - Ductility based design.

UNIT III DESIGN AGAINST BLAST AND IMPACT **9**

Characteristics of internal and external blast - Impact and impulse loads - Pressure distribution on buildings above ground due to external blast - underground explosion - Design of buildings for blast and impact as per BIS codes of practice.

UNIT IV DESIGN AGAINST WIND **9**

Characteristics of wind - Basic and Design wind speeds - Effect of permeability of the structure - pressure coefficient - Aero-elastic and Aerodynamic effects - Design as per BIS code of practice including Gust Factor approach - tall buildings, stacks and chimneys.

UNIT V SPECIAL CONSIDERATIONS **9**

Energy absorption capacity - Ductility of the material and the structure - Detailing for ductility - Passive and active control of vibrations - New and favorable materials.

TOTAL = 45

TEXT BOOK :

1. Paulay, T. and Priestly, M.N.J., "A seismic Design of Reinforced Concrete and Masonry building", John Wiley and Sons, 1991.

2. S.R.Damodarasamy, S.Kavitha "Basics of Structural dynamics and Aseismic Design", PHT Learning Private Limited., 2009.

3. Pankaj Agarwal, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2007.

REFERENCES:

1. Bela Goschy, "Design of Building to withstand abnormal loading", Butterworths, 1990.

2. Dowling, C.H., "Blast vibration - Monitoring and Control", Prentice Hall Inc., Englewood Cliffs, 1985.

3. Kolousek, .V. et al., "Wind effects on Civil Engineering Structures", Elsevier, 1984.

PST 708 INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

GOAL

The course introduces planning, functional requirements, analysis and design of industrial buildings, Power plant structures and transmission structures. At the end of the course the student shall acquire knowledge pertaining to overall aspects of industrial/power plant structures.

OBJECTIVES

The course should enable the student to :

1. Classify Industries and Industrial structures. Plan layouts with lighting, ventilation and fire safety. Protect against noise and vibration. Follow Factories act guidelines.
2. Understand Industrial buildings. Know about steel and RC roofs. Understand folded plates, shell roofs and gantry girders, corbels and nibs and machine foundation.
3. Learn about Power Plant structures such as bunkers, silos, chimneys and cooling towers, steel storage tanks and nuclear containment structures.
4. Familiarize with Power Transmission structures like cables, transmission line towers, substation structures and tower foundations. Know how to test tower.

OUTCOMES

The students will be able to:

1. Plan layouts for different Industries. Incorporate lighting, ventilation and fire safety requirements in pre-design stage itself. Be conversant with and able to implement Factories act guidelines.
2. Select the best given choice for roofs. Analyse and design steel truss and frames, RC beam-slab, folded plates, shell roofs, gantry girders, corbels, nibs and machine foundations.
3. Analyse and design bunkers, silos, chimneys, cooling towers and steel storage tanks. Understand nuclear containment structures.
4. Do Analysis and design of cables, transmission line towers, substation structures and tower foundations. Be able to test any tower.

UNIT I PLANNING AND FUNCTIONAL REQUIREMENTS **10**

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines from Factories Act.

UNIT II INDUSTRIAL BUILDINGS **10**

Roofs for Industrial Buildings - Steel and RC - Folded Plates and Shell Roofs - Gantry Girders - Design of Corbels and Nibs - Machine Foundations.

UNIT III POWER PLANT STRUCTURES **10**

Bunkers and Silos - Chimney and Cooling Towers - Design of Steel storage tanks - Nuclear containment structures.

UNIT IV POWER TRANSMISSION STRUCTURES **15**

Cables - Transmission Line Towers - Substation structures - Tower foundations - Testing towers.

TOTAL = 45

TEXT BOOKS :

1. P.C. Varghese, Design of Reinforced Concrete Shells and Folded Plates,P.H.I Learning Private Limited, New Delhi,2010.
2. A.R. Santhakumar and S.S. Murthy, Transmision Line Structures, Tata McGraw-Hill 1992.

REFERENCES:

1. Procs. of advanced course on Industrial Structures, Structural Engineering Research Centre, 1982.
2. S.N. Manohar, Tall Chimneys - Design and Construction, Tata McGraw-Hill, 1985.
3. Dr. K. Rajagopalan - Storage Structures - Oxford IBH Publishing Company Ltd. 1989.
4. P.Srinivasulu and C.V. Vaidyanathan, Handbook of Machine Foundations, Tata McGraw-Hill 1976.

PST 709 MAINTENANCE AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

GOAL

To get the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

OBJECTIVES

The course should enable the students to :

1. Understand the concrete properties and thermal properties of concrete as a building material
2. Be familiar with the quality assurance procedure for concrete, construction errors, corrosion and climatic effects.
3. Understand the causes for distress in reinforced concrete structures, the methods of maintenance, inspection and damage assessment procedure.
4. Understand the repair materials and repair techniques and to learn the strengthening techniques used for concrete structures subjected to weathering corrosion, wear, fire, leakage and marine exposure..
5. Be familiar with the Engineered demolition techniques for Dilapidated structures.

OUTCOMES

The students will be able to:

1. Have the knowledge about the concrete based on their strength, permeability, thermal properties and cracking.
2. Appreciate the mechanisms of degradation of concrete structures, the durability aspects and the quality assurance procedure for durable concrete structures.
3. Assess the distressed structures, conduct field monitoring and non-destructive evaluation of concrete structures and maintain the structures
4. Select the suitable repair materials and adopt the appropriate repair techniques, strengthening technique for concrete structures subjected to weathering corrosion, wear, fire, leakage and marine exposure.
5. Have knowledge of demolition procedures used for Dilapidated structures.

UNIT I GENERAL **9**

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.

UNIT II INFLUENCE ON SERVICEABILITY AND DURABILITY **9**

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

UNIT III MAINTENANCE AND REPAIR STRATEGIES **9**

Definitions : Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV MATERIALS AND TECHNIQUES FOR REPAIR **9**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure.

UNIT V ENGINEERED DEMOLITION TECHNIQUES **9**

Engineered Demolition techniques for dilapilated structures - Case studies.

TOTAL : 45

TEXT BOOKS:

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures", Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.

REFERENCES:

1. M.S.Shetty, "Concrete Technology - Theory and Practice", S.Chand and Company, New Delhi, 1992.
2. Santhakumar, A.R., "Training Course notes on Damage Assessment and repair in Low Cost Housing", "RHDC-NBO", Anna University, July, 1992.
3. N.Palaniappan, "Estate Management, Anna Institute of Management", Chennai, 1992.
4. Lakshmipathy, Metal Lecture notes of Workshop on "Repairs and Rehabilitation of Structures", 29 - 30th October 1999.

PST 710 OPTIMIZATION IN STRUCTURAL DESIGN

L	T	P	C
3	0	0	3

GOAL

At the end of the course the student shall acquires knowledge of various programming methods for optimal design of structural elements and optimization by structural theorems for trusses and frames.

OBJECTIVES

The course should enable the student to :

1. Determine basic concepts such as minimum weight, minimum cost design, Objective function, constraints, classical methods.
2. Provide exercises for Linear programming, Integer Programming, Quadratic Programming, Dynamic Programming and Geometric Programming methods for Optimal design of structural elements.
3. Instill knowledge of Linear Programming methods for plastic design of frames, Computer search methods for univariate and multivariate Minimization.
4. Elucidate optimization by structural theorems, Maxwell, Mitchell and Heyman's Theorems for trusses and frames, fully stresses design with deflection constraints, optimality criterion methods.

OUTCOMES

The students will be able to:

1. Acquire information about concepts like minimum weight, minimum cost design, Objective function, constraints, classical methods.
2. Get acquainted with Linear programming, Integer Programming, Quadratic Programming, Dynamic Programming and Geometric Programming methods for Optimal design of structural elements.
3. Attain proficiency on Linear Programming methods for plastic design of frames, Computer search methods for univariate and multivariate Minimization.
4. Do optimization by structural theorems, Maxwell, Mitchell and Heyman's Theorems for trusses and frames, fully stresses design with deflection constraints, optimality criterion methods.

UNIT I INTRODUCTION **10**

Basic concepts of minimum weight, minimum cost design, Objective function, constraints, classical methods.

UNIT II OPTIMIZATION TECHNIQUES AND ALGORITHMS **10**

Linear programming, Integer Programming, Quadratic Programming, Dynamic Programming and Geometric Programming methods for Optimal design of structural elements.

UNIT III COMPUTER SEARCH METHODS **10**

Linear Programming methods for plastic design of frames, Computer search methods for univariate and multivariate Minimization.

UNIT IV OPTIMIZATION THEOREMS **15**

Optimization by structural theorems, Maxwell, Mitchell and Heyman's Theorems for trusses and frames, fully stresses design with deflection constraints, optimality criterion methods.

TOTAL = 45

TEXT BOOK :

1. S.S.Rao, Optimization Theory and Applications, Wiley Eastern Limited, New Delhi, 1977.

REFERENCES:

1. Uri Krisch, Optimum Structural Design, McGraw-Hill Book Co. 1981.
2. Richard Bronson, Operation Research, Schaum's Outline Series, McGraw-Hill Book Co, Singapore, 1983.

PST 711 PRESTRESSED CONCRETE

L	T	P	C
3	0	0	3

GOAL

To posses the students with knowledge about behaviour, analysis and design requirements for prestressed concrete members according to Indian design code requirements.

OBJECTIVES

The course should enable the students to :

1. Understand the basic concepts of prestressing.
2. Be acquainted with the codal provision for the design of prestressed concrete elements.
3. Understand the principles involved in the design of tensioned bridge decks.
4. Have comprehensive design knowledge about circular prestressing.
5. Understand the design concepts of pressure composite constructions.

OUTCOMES

The students will be able to:

1. Describe the systems and methods of prestressing and find the deflection of prestressed elements.
2. Design the prestressed concrete elements as per the codal provisions.
3. Design prestressed concrete tanks, poles and sleepers.
4. Find the flexural and shear strength of prestressed concrete composite members.
5. Design pretensioned and post tensioned concrete bridge decks.

UNIT I PRINCIPLES AND ANALYSIS FOR FLEXURE 9

Principles of Prestressing - Types of prestressing systems - Materials - Systems and devices - Analysis and design for flexure- Behaviour of prestressed concrete elements - General concept of prestress - Force transmitted by pretensioned and post tensioned systems - losses in prestress - analysis for Ultimate strength - Comparison of codal provisions - at service load and Magnel's approach.

UNIT II DESIGN FOR FLEXURE 9

Concept of Limit State design - Limit state of Collapse and serviceability - Design using allowable stresses - Stress range approach - Lin's approach - Magnel's approach.

UNIT III DESIGN FOR SHEAR, TORSION AND ANCHORAGE ZONE 9

Shear resistance in beams - Design for shear in rectangular and flanged beams - Behaviour under torsion -Modes of failure - Design for torsion, shear and bending Anchorage Zone - analysis and design of pretensioned and post tensioned end blocks - IS code provisions - Comparison of other codes.

UNIT IV STATICALLY INDETERMINATE STRUCTURES 9

Analysis of indeterminate structures - Continuous beams - Concept of concordance and linear transformations - Single storied rigid frames - Choice of cable profiles.

UNIT V PRESTRESSED SPECIAL STRUCTURES 9

Concept of circular prestressing - Design of prestressed concrete pipes and cylindrical water tanks - Composite construction- types, behaviour, flexural stresses, longitudinal shear transfer, transverse shear - Compression members - Design of poles and piles - Partial pre stressing - Principles, analysis and design concepts

TOTAL = 45

TEXT BOOKS :

1. N.Rajagobalan ,"Prestressed Concrete" Norosa Publishing House (2002)
2. N.Krishnaraju, "Prestressed Concrete" Tata McGraw-Hill Publishing Company 3rd Ed (1985)

REFERENCES :

1. T.Y.Lin & Nedbhurns "Design of Prestressed Concrete Structures"3rd edition (1982), John Wiley & Sons
2. N.C.Sinha & S.K.Roy, "Fundamentals of Prestressed Concrete" S.Chand & Co, New Delhi (1985)

PST 712 STABILITY OF STRUCTURES

L	T	P	C
3	0	0	3

GOAL

To make the students understand the need for the stability of columns, beam-columns, portal frames, beams and plates.

OBJECTIVES

The course should enable the students to :

1. Get a basic understanding of the stability of columns and the buckling modes .
2. Understand the various methods of analysis of columns, column curves and inelastic behaviour of columns.
3. Get exposed to the buckling behaviour of beam-columns, portal frames and stability of multi-storeyed frames.
4. Get a better understanding of lateral buckling of beams, torsional buckling and flexural torsional buckling.
5. Understand the concept of buckling of thin isotropic rectangular plates.

OUTCOMES

The students will be able to:

1. Gain knowledge about the stability of columns and the buckling modes .
2. Use the various methods of analysis of columns, column curves and inelastic behaviour of columns.
3. Identify and evaluate the buckling of beam-columns, portal frames and stability of multi-storeyed frames.
4. Evaluate the lateral buckling of beams, torsional buckling and flexural torsional buckling.
5. Apply the concept of buckling of thin isotropic rectangular plates.

UNIT I STABILITY OF COLUMNS **9**

Concepts of Elastic Structural stability- Analytical approaches to stability - characteristics of stability analysis- Elastic Buckling of columns- Equilibrium; Energy and Imperfection approaches - Non-prismatic columns- Built up columns- orthogonality of buckling modes- Effect of shear on buckling load - Large deflection theory.

UNIT II METHODS OF ANALYSIS AND INELASTIC BUCKLING **9**

Approximate methods - Rayleigh and Galerkin methods - numerical methods - Finite difference and finite Element - analysis of columns - Experimental study of column behaviour - South well plot - Column curves - Derivation of Column design formula - Effective length of Columns - Inelastic behaviour- Tangent modulus and Double modulus Theory

UNIT III BEAM COLUMNS AND FRAMES 9

Beam column behaviour- standard cases- Continuous columns and beam columns - Column on elastic foundation - Buckling of frames - Single storey portal frames with and without side sway - Classical and stiffness methods - Approximate evaluation of critical loads in multistoried frames - Use of Wood's charts.

UNIT IV BUCKLING OF BEAMS 9

Lateral buckling of beams - Energy method- Application to Symmetric and simply symmetric I beams - simply supported and Cantilever beams - Narrow rectangular cross sections- - Numerical solutions - Torsional buckling - Uniform and non uniform Torsion on open cross section - Flexural torsional buckling - Equilibrium and energy approach.

UNIT V BUCKLING OF THIN PLATES 9

Isotropic rectangular plates - Governing Differential equations - Simply Supported on all edges - Use of Energy methods - Plates with stiffeners - Numerical Techniques.

TOTAL = 45

TEXT BOOKS:

1. Ashwini kumar, "Stability of Structures", Allied Publishers Ltd, (1998)
2. NGR Iyengar, "Structural Stability of Columns and Plates" Affiliated East- West Press Pvt. Ltd (1986)
3. Stephen P. Timoshenko and Gere "Theory of Elastic stability", McGraw-Hill Company (1963).

REFERENCES :

1. Allen, H.G and Bulson, P.S., Background to Buckling McGraw-Hill Book Company, 1980
2. Chajes, A. Principles of Structures Stability Theory, Prentice Hall 1974.

PST 713 DESIGN OF SUBSTRUCTURES

L	T	P	C
3	0	0	3

GOAL

To make the students understand the need of soil investigation, its importance in the choice of foundation and the design of suitable foundation for multi-storeyed buildings, industrial structures and towers.

OBJECTIVES

The course should enable the students to :

1. Get a basic understanding of the geotechnical site investigation.
2. Understand the types of foundations and the design concepts of shallow foundations.
3. Get exposed to design concepts of pile foundation.

4. Study the design principles of foundations for tower and caisson foundation.

5. Get sufficient knowledge about Machine foundations used in industrial structures.

OUTCOME

The students will be able to:

1. Plan a subsurface exploration and select appropriate drilling, sampling and field testing techniques for different soils.

2. Gain knowledge on the appropriate bearing capacity and settlement components of shallow foundation to be used in design and to conduct various tests to find the bearing capacity of foundation.

3. Identify the appropriate type of pile for different soil profiles and evaluate the bearing capacity and settlement of pile groups.

4. Design foundations for tower and caisson foundation.

5. Identify and design the suitable type of machine foundation used in industrial structures.

UNIT I SUB SURFACE EXPLORATION 9

Purpose - Programme and Procedures - Interpretation of bore logs, soil data and exploration reports.

UNIT II SHALLOW FOUNDATIONS 9

Types of foundations and their specific applications - depth of foundation - bearing capacity and settlement estimates - structural design of isolated footings, strip, rectangular and trapezoidal combined footings - strap - balanced footings - raft foundation - Approximate flexible method of raft design - Compensated foundations.

UNIT III DEEP FOUNDATIONS 9

Types of Piles and their applications - Load capacity - Settlements - Group action - Design of piles and pile caps - Lateral load capacity of piles.

UNIT IV FOUNDATIONS FOR BRIDGES AND OTHER MISCELLANEOUS STRUCTURES 9

Drilled shaft foundations and caissons for bridges - Foundations for towers - Chimneys - Silos - Structural Design of supports for foundation excavations - Design of Anchors.

UNIT V MACHINE FOUNDATIONS 9

Types - General requirements and design criteria - General analysis of machine-foundations-soil system - Stiffness and damping parameters - Tests for design parameters - Guide lines for design of reciprocating engines, impact type machines, rotary type machines, framed foundations.

TOTAL : 45

TEXT BOOK :

1. Thomlinson, M.J. and Boorman. R. "Foundation Design and Construction", ELBS Longman VI edition, 1995.

REFERENCES :

1. Nayak, N.V., "Foundation Design manual for Practicing Engineers", Dhanpat Rai and Sons, 1982.
2. Winterkorn H.F., and Fang H.Y., "Foundation Engineering Hand Book - Van Nostrard - Reinhold - 1976.
3. Brain J Bell and M.J. Smith "Reinforced Concrete Foundations" George Godwin Ltd.
4. Braja M. Das "Principles of Foundations Engineering" Thomson Asia (P) Ltd.
5. Bowels J. E "Foundation Analysis and Design" McGraw-Hill International Book Co.

PST 714 ASEISMIC DESIGN OF STRUCTURES

GOAL

To introduce to the student the phenomena of earthquakes, the process, measurements and the factors that affects the design of structures in seismic areas.

OBJECTIVES

The course should enable the students to:

1. Throw light on the causes of earthquake and its characteristics.
2. Have knowledge about the response of various structural systems under earthquake loading.
3. Be familiarize with the codal provisions and the aseismic design methodology.
4. Understand the basic design concepts of earthquake resistant non-engineered structures, bridges and dams.
5. Know the modern concepts of vibration control devices.

OUTCOME

The students will be able to:

1. Gain knowledge on the causes of earthquake and the damage on the structures caused by earthquake. Also to learn the lessons from the past earthquakes.
2. Use appropriate structural systems to resist the earthquake and also to gain knowledge on the behavior of RC, steel and pre stressed concrete elements.

3. Design and detail the reinforced concrete structures using the codal provisions.

4. Design the masonry structures, bridges and dams against earthquake.

5. Design earthquake resistant structures and adopt appropriate vibration control techniques.

UNIT I ELEMENTS OF ENGINEERING SEISMOLOGY **9**

Elements of Engineering Seismology - Characteristics of Earthquakes - History - Seismic Susceptibility of Indian Subcontinent - Performance of structures under past earthquakes, Lessons learnt from past earthquakes.

UNIT II RESPONSE OF STRUCTURES TO EARTHQUAKE **9**

Building Systems - Rigid Frames, Braced Frames, Shear Walls - Behaviour of RC, steel and prestressed concrete elements under cyclic loading - Soil performance.

UNIT III EARTHQUAKE RESISTANT DESIGN **9**

Concept of Earthquake Resistant Design - Provisions of Seismic Code IS 1893 (Part I) - 2002 - Response Spectrum - Design Spectrum - Structural Configuration - 3 D computer analysis of building (Theory) - Design and Detailing of Frames, Shear Walls and Framed Walls - Provisions of IS-13920.

UNIT IV DESIGN PROVISIONS **9**

Design of Non Engineered construction - strengthening of buildings - Design Provisions for Bridges and Dams.

UNIT V VIBRATION CONTROL **9**

Modern Concepts - Base Isolation - Adoptive systems - Case studies.

TOTAL = 45

TEXT BOOKS:

1 Pankaj Agarwal, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2007

2. S.R.Damodarasamy, S.Kavitha "Basics of Structural dynamics and Aseismic Design", PHT Learning Private Limited., 2009.

REFERENCES:

1. Anil K Chopra, "Dynamics of structures - Theory and applications to Earthquake Engineering", Prentice Hall Inc., 2001.

2. Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", McGraw-Hill Book Company, New York, 1986.