M.Tech, AR - 22

1st& 2nd Year M. Tech.,

COURSE STRUCTURE AND SYLLABUS

For

STRUCTURAL ENGINEERING

(Applicable for the batches admitted from 2022-23)

DEPARTMENT OF CIVIL ENGINEERING

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AUTONOMOUS)

Approved By AICTE, New Delhi
Recognized under 2(f),12(b) of UGC
Permanently Affiliated to JNTUGV, Vizianagaram
Accredited by NBA (UG Programs; CSE, ECE, EEE, ME, CE & IT)
Accredited by NAAC (UGC) with A+ Grade
K. Kotturu, TEKKALI-532 201, Srikakulam, Andhra Pradesh

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AUTONOMOUS)
Approved by AICTE, Accredited by NBA & NAAC, Recognised under 2(f)12(b) of UGC,
Permanently Affiliated to JNTUGV, Vizianagaram.
K.Kotturu, Tekkali, Srikakulam-532201, Andhra Pradesh

Academic Regulations for M.Tech
(Effective for the students admitted into first year from academic year 2022-2023)

The M.Tech Degree of the Aditya Institute of Technology and Management (Autonomous), Tekkali shall be conferred on candidates who are admitted to the program and fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS:

Admission to the above program shall be made subject to the eligibility, qualifications and specialization prescribed by the University from time to time. Admissions shall be made on the basis of merit / rank obtained by the qualifying candidate in GATE / PGCET, subject to reservations prescribed by the Govt. of AP from time to time.

2.0 AWARD OF M. Tech DEGREE:

2.1 A student shall be declared eligible for award of the M.Tech degree, if he/she pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years.

2.2 A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

2.3 The student shall register for all 68 credits and secure all the 68 credits.

3.0 ATTENDANCE:

3.1 The minimum instruction for each semester 90 clear instruction days.

3.2 A candidate shall be deemed to have eligibility to write End Semester examinations if he/she has put in a minimum of 75% of attendance in aggregate of all the subjects.

3.3 Condonation of shortage of attendance up to 10% (65% and above, and below 75%) may be given by the College academic committee.

3.4 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representations by the candidate with supporting evidence.

3.5 Shortage of attendance below 65% shall in NO case be condoned.

3.6 A candidate shall not be promoted to the next semester unless he/she fulfills the attendance requirements of the present semester.

3.7 A stipulated fee shall be payable towards condonation of shortage of attendance.

4.0 COURSE OF STUDY:

The following specializations are offered at present for the M.Tech course of study.

1	VLSI System Design
2	Power Electronics and Drives
3	Computer Science and Engineering
4	Structural Engineering
5	Thermal Engineering

4.1 A standard academic format common for all PG programmes describing numbers of credits, weightage for lecture, laboratories work and projects have been fixed considering the scope of study. The position and sequence of study of core courses and elective courses are made to ensure sequential and integral learning. The focus on advance study in core courses through theory and laboratories work supported by study on relevant programme specific electives are incorporated. The selection of unique courses in the basket of elective is a special feature of curriculum ensuring flexibility and diversity. The emphasis on understanding advanced Concepts of PG course is ensured through elaborate practical work conducted through actual/virtual laboratory experiments. The concept of designing experiments and developing concept application is made part of learning process. The PG course is spread over two years in four semesters and inclusion of Minor project, Audit course, Open elective, Technical Seminar and Dissertation are the special features of this curriculum. The contents of course are unitised to facilitate its execution. The list of suggested reading is also made part of the curriculum.

4.2 The students are asked to learn IPR/ research methodology to understand the importance and process of creation of patents through research. The introduction of One Audit course covering subjects of developing desired attitude among the Learners is on the line of initiatives such as English for research paper writing, Disaster management, and Constitution of India and Personality development through life enlightenment skills. The courses included under open electives are of importance in the context of special skill development and they are on Industrial safety, Operation research, Composite materials and Waste to Energy. These courses shall make students capable to work in industrial environment.

4.3 The introduction of Minor project ensures preparedness of students to undertake major projects/ dissertation. Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break. The dissertation/major project work of PG programme of one-year duration is given strong weightage in the curriculum. It is expected to undertake industrially relevant problem to develop an optimal solution through extensive research work. The students and faculty can design the research project in consultation with industry preferably in the region.

5.0 EVALUATION:

The performance of the candidate in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for laboratory, on the basis of continuous Internal Evaluation and Semester End Examination.

5.1 For Theory Courses, **40** marks shall be for internal evaluation and **60** marks for end semester examination. Out of 40 internal marks 30 marks are assigned for subjective exam, 5 marks for assignments and 5 marks for seminars. The internal evaluation for 30 marks shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted, one in the middle of the Semester and the other immediately after the completion of instruction. Each midterm examination shall be conducted for duration of **120** minutes and question paper shall contain **4** questions. The student should answer all **4** questions.

5.2 For courses like **Research Methodology & IPR** and **Open Elective,** the pattern of midterm and end examinations is similar to regular theory courses and the valuation is purely internal. Evaluation is based on continuous assessment.

5.3 Audit course is one among the compulsory courses and does not carry any Credits and no semester end examination.

5.4 For laboratory courses, **40** marks shall be for internal evaluation and **60** marks for end semester examination. Out of **40** internal marks **20** marks are assigned based on day-to-day evaluation and **20** are assigned based on the internal test. The end examination shall be conducted by the teacher concerned and an external examiner.

5.5 For Minor Project, **40** marks shall be for internal evaluation and **60** marks for end semester examination. The end semester examination (Viva-Voce) shall be conducted by a committee. The committee consists of an External examiner, Head of the department and Supervisor of the minor project. The internal evaluation shall be made on the basis of seminar given by each student on the topic of his/her minor project, which was evaluated by Departmental committee. The Departmental Committee consists of Head of the Department, supervisor and one other senior faculty member from the Department. Out of **40** internal marks **10** marks allotted for literature survey, **15** marks for results and analysis and 15 marks for seminar.

5.6 For Technical Seminar there will be only internal evaluation for **100** marks. A candidate has to secure a minimum of **50%** marks to be declared successful. For evaluation the candidate has to collect literature on a topic, prepare the document, submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department and two other senior faculty members from the department.

5.7 A candidate shall be deemed to have secured the academic requirement in a subject if he/she secures a minimum of 40% of marks in the end semester examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

5.8 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.7) he has to reappear for the supplementary examination in that subject in the next academic year.

6.0 EVALUATION OF DISSERTATION Phase – 1/DISSERTATION Phase – 2 WORK:

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Dissertation Review Committee.

6.1 A DISSERTATION Review Committee (DRC) shall be constituted with Principal as chair Person, Head of the department, Supervisor and one senior faculty member of the concerned department.

6.2 Registration of DISSERTATION: A candidate is permitted to register for the Dissertation after satisfying the attendance requirement of all the subjects (theory and practical subjects) in Second semester.

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his supervisor, the title, objective and plan of action of his dissertation work to the Dissertation Review Committee for its approval. After obtaining the approval of the Committee the student can initiate the dissertation work after the second semester end examinations.

6.4 Every candidate shall work on dissertation approved by the DRC of the Department.

6.5 If a candidate wishes to change his supervisor or topic of the dissertation he can do so with approval of the DRC. However, the Dissertation Review Committee (DRC) shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the dissertation work starts from the date of change of Supervisor or topic as the case may be.

6.6 A candidate shall submit status report in two stages at least with a gap of 3 months between them.

6.7 The work on the dissertation shall be initiated in the beginning of the III semester and the duration of the dissertation is for two semesters. The candidate shall identify the problem, Literature survey, design/modeling part of the problem i.e. almost 35% of his dissertation work should be completed in the III semester itself and it will be evaluated by DRC as Dissertation Phase – 1. If the candidate fails to get the satisfactory report, he has to re-register for the dissertation work.

6.8 A candidate shall be allowed to submit the dissertation report only after fulfilling the attendance requirements of all the semesters with approval of DRC and not earlier than 40 weeks from the date of registration of the dissertation work. For the approval of DRC the candidate shall submit the draft copy of dissertation to the Principal (through Head of the Department) and shall make an oral presentation before the DRC.

6.9 The Candidate may be permitted to submit the Dissertation Report, if only the student pass in all subjects and work is Published/Accepted to be published in a Journal / International conference of repute and relevance.

6.10 Three copies of the Dissertation Report certified by the Supervisor shall be submitted to the College.

6.11 The Dissertation shall be adjudicated by external examiner from outside the college.

6.12 The viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner outside the college.

The Board shall jointly report candidates work as:
A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination. If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination, the candidate may be asked to submit a new Dissertation proposal to DRC starting with 6.4

7. Method of Awarding Letter Grades and Grade Points for a Course:

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table: Grading System for M.Tech. Programme

Percentage	Level	Letter Grade	Grade Points
>= 90%	Outstanding	A+	10
80 to <90%	Excellent	A	9
70 to <80%	Very Good	B	8
60 to <70%	Good	C	7
50 to <60%	Fair	D	6
< 50%	Fail	F	0
-	Absent	AB	0

7.1 Calculation of Semester Grade Points Average (SGPA)* for semester

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as below:

$$SGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR}$$ (for all courses passed in semester)

Where CR = Credits of a Course
GP = Grade points awarded for a course

SGPA is calculated for the candidates who passed all the courses in that semester.

7.2 Calculation of Cumulative Grade Points Average (CGPA) and Award of Division for Entire Programme.

The CGPA is calculated as below:

$$CGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR}$$ (for entire programme)

Where CR = Credits of a course
GP = Grade points awarded for a course

CGPA is calculated for the candidates who passed all the courses till that semester.

As per the AICTE regulations, conversion of CGPA into equivalent percentage as follows:
Equivalent Percentage = (CGPA – 0.75) x 10

After a student has satisfied the requirement prescribed for the completion of the programme and is eligible for receiving the award of M.Tech. Degree, he shall be placed in one of the below divisions:

Table: Award of Divisions

Class Awarded	**CGPA**	**Secured Remarks**
First Class with distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 68 Credits
First Class	≥ 6.75	
Second Class	≥ 6.0 and < 6.75	

8.0 WITH-HOLDING OF RESULTS:

If the candidate has not paid any dues to the college or if any case of indiscipline is pending against him / her, the result of the candidate will be withheld and he/she will not be allowed into the next higher semester. The issue of the degree is liable to be withheld in such cases.

9.0 TRANSITORY REGULATIONS:

Candidate who have discontinued or have been detained for want of attendance or who have failed after having undergone the course are eligible for admission to the same or equivalent subjects as and when subjects are offered, subject to 5.8 and 2.0.

10.0 GENERAL:

10.1 The academic regulations should be read as a whole for purpose of any Interpretation.

10.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

10.3 The Institute may change or amend the academic regulations and syllabus at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the college.

10.4 Wherever the word he, him or his occur, it will also include she, her and hers.

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COURSE STRUCTURE

Semester	COURSE CODE	Theory/Lab	L	T	P	C
I	22MSE1001	Advanced Structural Analysis	3	0	0	3
	22MSE1002	Analytical and Numerical Methods for Structural Engineering	3	0	0	3
	Elective – 1		3	0	0	3
	22MSE1003	Theory of Thin Plates and Shells				
	22MSE1004	Advanced Concrete Technology				
	22MSE1005	Stability of Structures				
	Elective – 2		3	0	0	3
	22MSE1006	Advanced Solid Mechanics				
	22MSE1007	Structural Health Monitoring				
	22MSE1008	Structural Optimization				
	22MSE1101	Structural Design Lab	0	0	4	2
	22MSE1102	Advanced Concrete Technology Lab	0	0	4	2
	22MCC1001	Research Methodology and IPR	2	0	0	2
	Audit Course		2	0	0	0
	22MAC1001	English for Research Paper Writing				
	22MAC1002	Disaster Management				
	22MAC1003	Constitution of India				
	22MAC1004	Personality Development through Life Enlightenment Skills				
Total			**16**	**0**	**8**	**18**

Semester	COURSE CODE	Theory/Lab	L	T	P	C
II	22MSE1009	Finite Element Analysis	3	0	0	3
	22MSE1010	Structural Dynamics	3	0	0	3
	Elective – 3		3	0	0	3
	22MSE1011	Advanced Steel Design				
	22MSE1012	Design of Formwork				
	22MSE1013	Design of High Rise Structures				
	Elective – 4		3	0	0	3
	22MSE1014	Design of Advanced Concrete Structures				
	22MSE1015	Advanced Design of Foundations				
	22MSE1016	Design of Industrial Structures				
	Program Elective – 5		3	0	0	3
	22MSE1017	Design of Pre stressed Concrete Structures				
	22MSE1018	Prefabricated Structures				
	22MSE1019	Fracture Mechanics of Concrete				
	22MSE1103	Numerical Analysis Lab	0	0	4	2
	22MSE1201	Minor Project	0	0	4	2
	xxxxxxxxxx	Open Elective	3	--	--	3
Total			**18**	**0**	**8**	**22**

II	**Open Elective**	
	22MOE1001	Industrial Safety
	22MOE1002	Operations Research
	22MOE1003	Composite Materials
	22MOE1004	Waste to Energy

Semester	**COURSE CODE**	**Theory/Lab**	**L**	**T**	**P**	**C**
III	22MSE2202	Technical Seminar	0	0	4	2
	22MSE2203	Dissertation Phase – 1	0	0	20	10
Total			**0**	**0**	**24**	**12**

Semester	**COURSE CODE**	**Theory/Lab**	**L**	**T**	**P**	**C**
IV	22MSE2204	Dissertation Phase – 2	0	0	32	16
Total			**0**	**0**	**32**	**16**

NOTE: L: Lecture T: Tutorial P: Practical

Advanced Structural Analysis

COURSE CODE: 22MSE1001

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To study Basic concepts in structural analysis like Static Indeterminacy and kinematic indeterminacy, Applications of principle of virtual work
2. To study Force methods, Displacement Methods.
3. To study Matrix concepts and coordinate systems & element and structure stiffness matrices.
4. To study Matrix analysis of structures with axial elements of Plane trusses, Space trusses with different degree of freedoms.
5. To study Stiffness method, development of grid elemental stiffness matrix, idealizing the beam stiffness solutions, curved beam element stiffness matrix.
6. To study Flexibility method for fixed and continuous beams.

COURSE OUTCOMES:

1. Analyze Basic concepts in structural analysis
2. Analysis the skeleton structures using Force methods, Displacement Methods
3. Study Matrix concepts, coordinate systems, Contra-gradient principle.
4. Study& Analyze Matrix analysis of structures with axial elements with different degree of freedoms.
5. Analyze the beams and grids by Stiffness method & Matrix applications.
6. Analyze the beams by Flexibility method & Matrix applications.

UNIT-I

Basic concepts in structural analysis: Structure -structural elements, joints and supports, stability, rigidity and static indeterminacy, kinematic indeterminacy; Loads-direct actions, indirect loading; Response -equilibrium, compatibility, force-displacement relations; Levels of analysis; analysis of statically determinate structures (trusses, beams, frames); Applications of principle of virtual work and displacement-based and force-based energy principles; deriving stiffness and flexibility coefficients.

UNIT-II

Analysis of indeterminate structures: Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work). Displacement Methods: Kinematically indeterminate structures (slope-deflection method; moment distribution method).

UNIT-III

Matrix concepts and Matrix analysis of structures: Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; Eigen values and eigenvectors. Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches

UNIT-IV

Matrix analysis of structures with axial elements: Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof); One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method; Plane trusses: Analysis by conventional stiffness method (four dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method; Space trusses: Analysis by conventional stiffness method (six dof per element) and reduced element stiffness method (single dof).

UNIT-V

Matrix analysis of beams and grids: Conventional stiffness method for beams: Beam element stiffness (four dof); generation of stiffness matrix for continuous beam; dealing with internal hinges, hinged and guided-fixed end supports; accounting for shear deformations; Reduced stiffness method for beams: Beam element stiffness (two dof); dealing with moment releases, hinged and guided-fixed end supports.

UNIT-VI

Flexibility method for fixed and continuous beams: Force transformation matrix; element flexibility matrix; solution procedure 10 flexibility matrix; solution procedure (including support movements); Stiffness method for grids: Introduction; torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element with six dof; analysis by reduced stiffness method (three dof per element)

Textbooks:

1. Matrix Analysis of Framed Structures, Weaver and Gere.
2. Computer Methods in Structural Analysis, MeekJ. L., E and FN, Span Publication.
3. Devdas Menon,"Advanced Structural Analysis", Narosa Publishing House, 2009.
4. AsslamKassimali,"Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA, 1999.
5. Amin Ghali,Adam M Neville and Tom G Brown,"StructuralAnalysis:A Unified Classical and Matrix Approach",Sixth Edition, 2007, Chapman & Hall.
6. DevdasMenon,"StructuralAnalysis", Narosa Publishing House, 2008

References:

1. The Finite Element Method, Lewis P. E. and WardJ. P., Addison-Wesley Publication Co.
2. The Finite Element Method, Desai and Able, CBS Publication.

Analytical and Numerical Methods for Structural Engineering

COURSE CODE: 22MSE1002

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

Students will have

1. To solve the algebraic and transcendental equations, using different numerical method.
2. To Estimate the unknown function.
3. To estimate the value of derivatives, evaluate the definite integrals using different numerical methods
4. Calculate the numerical solution of an ordinary differential equation i.e. IVP.
5. To solve linear system of equations by Numerical Methods.
6. To solve boundary value and Eigen value problems by different methods.

COURSE OUTCOMES

On completion of this course, students should be able

1. Solve the algebraic and transcendental equations by identifying suitable numerical methods.
2. Estimate the value of dependent variable for a particular x by deducing the unknown function y = f(x) for an evenly or unevenly spaced points.
3. Estimate the value of derivatives, evaluate the definite integrals using different numerical methods.
4. Solve the IVP using different numerical methods.
5. Solve linear system of equations by LU –Factorization, Matrix Inverse, Gauss seidal Method, Tridiagonalization and QR Factorization.
6. Evaluate boundary value and Eigen value problems by Shooting method, Finite difference method, Polynomial method and Power method.

SYLLABUS:

UNIT-I

Numerical solutions of Algebraic and Transcendental Equations:

Introduction-The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

UNIT-II

Interpolation:

Introduction –Finite differences- Forward Differences – Backward differences – Central differences – Symbolic relations and separation of symbols-Differences of a polynomial – Newton's formulae for interpolation – Interpolation with unevenly spaced points– Lagrange's Interpolation formula.

UNIT-III

Numerical Differentiation and Integration:
Numerical Differentiation using finite differences – Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

UNIT-IV

Solution of Ordinary Differential equations:
Solution by Taylor's series – Picard's Method of successive Approximations – Euler's and Modified Euler's Method – Runge – Kutta Methods – Predictor – Corrector Methods – Milne's Method.

UNIT-V

Numerical Methods in Linear Algebra:
LU –Factorization, Matrix Inverse, Gauss seidal Method, Tridiagonalization and QR-Factorization.

UNIT-VI
Boundary Value Problems and Eigen value problems:
Shooting method, finite difference method, solving Eigen Values by power method and Iteration (Power Method)

Text Books:

1. Higher Engineering Mathematics, 42nd edition, 2012 - B. S. Grewal, Khanna Publishers, New Delhi.
2. Introductory Methods of Numerical Analysis- Sastry, S.S, Prentice-Hall, 2nd Edition, 1992.

Reference Books:

1. Mathematical Methods, 6th edition, 2011, Dr. T. K.V.Iyengar& others S. Chand Publications.
2. Numerical Methods by E. Balaguruswamy, Tata Mc Grewal
3.An introduction to numerical analysis, Atkinson K.E., J. Wiley and sons, 1989

Theory of Thin Plates and Shells
(Elective-1)

COURSE CODE:22MSE1003

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
Students will have

1. To study Derivation of plate equation for -in plane bending and transverse bending effects, Rectangular Plates.
2. Plates under various loading conditions like sinusoidal loading, uniformly distributed load and hydrostatic pressure.
3. To study Circular plates, symmetrically loaded, circular plates under various loading conditions, annular plates.
4. To study Equations of Equilibrium, Derivation of stress resultants, Principles of membrane theory and bending theory.
5. To study Cylindrical Shells, Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells.
6. To study Introduction to the shells of double curvatures: Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

COURSE OUTCOMES:
Students will get ability

CO-1 To study Derivation of plate equation for -in plane bending and transverse bending effects, Rectangular Plates,
CO-2 Plates under various loading conditions like sinusoidal loading, uniformly distributed load and hydrostatic pressure.
CO-3 To study Circular plates, symmetrically loaded, circular plates under various loading conditions, annular plates.
CO-4 To study Equations of Equilibrium, Derivation of stress resultants, Principles of membrane theory and bending theory.
CO-5 To study Cylindrical Shells, Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells.
CO-6 To study Introduction to the shells of double curvatures: Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

SYLLABUS:

UNIT-I
Derivation of plate equation for cylindrical bending of rectangular plates – analysis of UDL rectangular plates with simply supported edges and fixed edges – stain Energy in pure bending.

UNIT-II
Small Deflection theory thin Rectangular Plates: Plates under various loading conditions like sinusoidal loading, uniformly distributed load Navier and Levy's type of solutions for various boundary conditions and hydrostatic pressure.

UNIT-III

Circular plates: Symmetrically loaded, circular plates under various loading conditions, Annular plates.

UNIT-IV

Equations of Equilibrium: Derivation of stress resultants, Principles of membrane theory and bending theory.

UNIT-V

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

UNIT-VI

Introduction to the shells of double curvatures: Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

Text Books:

1. Theory of plates and shells – Timoshenko and Krieger, McGraw-Hill book company, INC, New Yark.
2. A Text Book of Plate Analysis – Bairagi, K, Khanna Publisher, New Delhi.
3. Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw – Hill, New Yark.

References :

1. Theory of plates by Chandrasekhar, University press

Advanced Concrete Technology
(Elective-1)

COURSE CODE: 22MSE1004

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Students will have to

1. To study Materials- Cement, Aggregates, mixing water soundness of aggregate, Fresh and hardened concrete, Admixtures, types of admixtures, purposes of using admixtures- chemical composition.
2. To study Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms, Acoustical emission methods- Corrosion activity measurement, Impact echo methods- Ultrasound pulse velocity methods
3. To study Repair and rehabilitation of structural elements, Analysis, and design, Material requirement, Surface preparation- Reinforcing steel cleaning, repair and protection
4. To study Strengthening and stabilization, design considerations, Beam shear capacity strengthening- Shear Transfer strengthening, Column strengthening, flexural strengthening.
5. To study Fibre reinforced concrete, Properties of constituent materials, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes.
6. To study Light weight concrete, properties of light weight concrete, design of light weight concrete, High performance concretes, Development of high performance concretes, Materials of high performance concretes, Properties of high performance concretes.

COURSE OUTCOMES:

Students will be able to

1. To learn Materials- Cement, Aggregates, mixing water soundness of aggregate, Fresh and hardened concrete, Admixtures, types of admixtures, purposes of using admixtures- chemical composition.
2. To learn Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms, Acoustical emission methods- Corrosion activity measurement, Impact echo methods- Ultrasound pulse velocity methods
3. To learn Repair and rehabilitation of structural elements, Analysis, and design, Material requirement, Surface preparation- Reinforcing steel cleaning, repair and protection
4. To learn Strengthening and stabilization, design considerations, Beam shear capacity strengthening- Shear Transfer strengthening, Column strengthening, flexural strengthening.
5. To learn Fibre reinforced concrete, Properties of constituent materials, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes.
6. To learn Light weight concrete, properties of light weight concrete, design of light weight concrete, High performance concretes, Development of high performance concretes, Materials of high performance concretes, Properties of high performance concretes.

SYLLABUS:

UNIT-I

Materials- Cement, Aggregates, mixing water soundness of aggregate- Fresh and hardened concrete: Admixtures- types of admixtures- purposes of using admixtures- chemical composition- effect of admixtures on fresh and hardened concretes- Natural admixtures.

UNIT-II

Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests

UNIT-III

Repair and rehabilitation of structural elements: Analysis, strategy and design- Material requirement- Material selection- Surface preparation- Reinforcing steel cleaning, repair and protection- Bonding repair materials to existing concrete- placement methods-

UNIT-IV

Strengthening and stabilization- Techniques- design considerations- Beam shear capacity strengthening- Shear Transfer strengthening- stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening Crack stabilization

UNIT-V

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes.

UNIT-VI

Light weight concrete- Introduction- properties of light weight concrete- No fines concrete- design of light weight concrete. High performance concretes- Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes.

Text Books:

1. Concrete Technology by M S Shetty.
2. Concrete Technology by Neville & Brooks.
3. Special Structural concrete by Rafat Siddique.
4. Concrete repair and maintenance illustrated by Peter H Emmons.

REFERENCE BOOKS:

1. Job Thomas., " Concrete Technology", Cenage learning,
2. R. Santhakumar „ Concrete Technology", Oxford Universities Press, 2006

Stability of Structures
(Elective-1)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1005

COURSE OBJECTIVES:
Students will have

1. To study Beam columns, Differential equation for beam columns, Beams column with concentrated loads continuous lateral load, Beam column with built in ends, continuous beams with axial load.
2. To study Elastic buckling of bars, Elastic buckling of straight columns, Sway & Non Sway mode, Energy methods.
3. To study Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads, Effect of shear force on critical load Buckling of frames.
4. To study Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling.
5. To study Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method – Timeshinko method, Galerkin method.
6. To study Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending.

COURSE OUTCOMES:
Students will get ability

1. To learn Beam columns, Differential equation for beam columns, Beams column with concentrated loads continuous lateral load, Beam column with built in ends, continuous beams with axial load.
2. To learn Elastic buckling of bars, Elastic buckling of straight columns, Sway & Non Sway mode, Energy methods.
3. To learn Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads, Effect of shear force on critical load Buckling of frames
4. To learn Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling.
5. To learn Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method – Timeshinko method, Galerkin method.
6. To learn Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending.

SYLLABUS:

UNIT-I

Beam-columns: Differential equation for beam columns – Beams-column with concentrated loads – continuous lateral load – couples – Beam-column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses.

UNIT-II

Elastic buckling of bars: Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods.

UNIT-III

Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode.

UNIT-IV

Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling.

UNIT-V

Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method – Timeshinko method, Galerkin method.

UNIT-VI

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending.

Text Book :

1. Theory of Elastic stability by Timshenko & Gere-Mc Graw Hill

REFERENCES:

1. Stability of Metal Structures by Bleinch – Mc Graw Hill
2. Theory of beam columns Vol I by Chem. & Atsute Mc. Graw Hill.
3. Theory of Stability of Structures by Alexander Chases.

Advanced Solid Mechanics
(Elective-2)

COURSE CODE: 22MSE1006

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To study Elasticity, Displacement, stress and strain fields, components of stess and strain, Equations of elasticity.
2. To study differential Equation of Equilibrium, concepts of stress and strain, Principle stress strain and principle axes.
3. To study stress strain relations, strain displacement relations and compatibility relations, Boundary conditions and boundary value problems.
4. To study Solve simple problems of Two Dimensional problems in Plane stress and Plane strain, Airy's stress Function and Polar Coordinates.
5. To study Saint Venent's Method, Homogeneous Torsion of Prismatic Bars, Membrane Analogy, Torsion of Rectangular Bars and Thin tubes.
6. To study Theory of plasticity concepts, Strain Hardening, Stress strain curve, Yield Criteria, Plastic stress – strain Relation and principle of normality and Plastic potential.

COURSE OUTCOMES:

After successful completion of this course, students will be able to

CO 1: To learn Elasticity, Displacement, stress and strain fields, components of stess and strain, Equations of elasticity.

CO 2: To learn differential Equation of Equilibrium, concepts of stress and strain,Principle stress strain and principle axes.

CO 3: To learn stress strain relations, strain displacement relations and compatibility relations, Boundary conditions and boundary value problems.

CO 4: Solve simple problems of Two Dimensional problems in Plane stress and Plane strain, Airy's stress Function and Polar Coordinates.

CO 5: To learn Saint Venent's Method, Homogeneous Torsion of Prismatic Bars, Membrane Analogy, Torsion of Rectangular Bars and Thin tubes.

CO 6: To learn Theory of plasticity concepts, Strain Hardening, Stress strain curve, Yield Criteria, Plastic stress – strain Relation and principle of normality and Plastic potential.

SYLLABUS:

UNIT-I

Introduction to Elasticity – Notation for Forces and Stresses – Components of Stresses – Components of Strain, Stress – Strain Fields, Displacements, Cartesian Tensors and Equations of Elasticity.

UNIT-II

Stress – Strain Fields – Elementary Concept of Stress and Strain, Principle Stress, Strain and Principle Axes, Compatibility Conditions, Stress at a Point, Strain at a point, Stress components on an Arbitrary Plane, Differential Equations of Equilibrium.

UNIT-III

Equations of Elasticity – Equations of Equilibrium, Stress – Strain Relations, Strain – Displacement Relations and Compatibility relations, Boundary Conditions and boundary value problems and Homogeneous Deformations.

UNIT-IV

Two - Dimensional Problems of Elasticity – Plane Stress and Plane Strain Problems, Airy's Stress Function, Two Dimensional Problems in Rectangular and Polar Coordinates.

UNIT-V

Torsion of Bars – saint Venant's Method, Membrane Analogy, Torsion of Rectangular Bars, Torsion of Prismatic Bars and Torsion of Thin Tubes.

UNIT-VI

Plastic Deformation – Theory of plasticity – concepts and assumption - yield criterions, Strain hardening, Idealized Stress – Strain Curve, Plastic Stress – Strain relations, Principle of Normality and Plastic Potential.

TEXT BOOKS:

1. Theory of Elasticity – Sadhu Singh, Khanna Publishers, 2003.
2. Advance Mechanics of Solids – L S Srinath., McGraw Hill, 3rd Edition, 2000.
3. Theory of Elasticity- Timoshenko S & Goodier J.N., McGraw Hill,3rd Edition,2010.

REFERENCES:

1.Theory of Elasticity and Plasticity – H. Jane Helena., PHI Learning private Limited,2017.

2. Theory of Elasticity and Plasticity – E.M.Lifshitz, A.M.Kosevich, L.P.Pitaevskii., Science Direct, 3rd Edition,1986.

Structural Health Monitoring
(Elective-2)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1007

COURSE OBJECTIVES:

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

1. To study Diagnosis the distress in the structure understanding the causes and factors.
2. To study Suggest Various Measures for Structural Health Monitoring.
3. To study Diagnosis the Structural health investigation.
4. To study Assess the health of structure using static field methods.
5. To study Assess the health of structure using dynamic field tests.
6. To study Suggest repairs and rehabilitation measures of the structure.

COURSE OUTCOMES:

1. To learn Diagnosis the distress in the structure understanding the causes and factors.
2. To learn Suggest Various Measures for Structural Health Monitoring.
3. To learn Diagnosis the Structural health investigation.
4. To learn Assess the health of structure using static field methods.
5. To learn Assess the health of structure using dynamic field tests.
6. To learn Suggest repairs and rehabilitation measures of the structure.

Syllabus :

UNIT – I:
Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

UNIT – II:
Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration

UNIT – III:
Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures

UNIT – IV:
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT – V:
Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring

UNIT – VI:
Repairs and Rehabilitations of Structures: Case Studies (Site Visits), Piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Reference Books:

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

Structural Optimization
(Elective-2)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1008

COURSE OBJECTIVES:

Students will have

1. To study the need and scope for optimization, historical development, objective function and its surface design variables, constraints and constraint surface, classification of optimization problems.
2. To study classical optimization techniques, multi variable optimization by method of constrained variation and Lagrange multipliers, Khun-Tucker conditions of optimality.
3. To study non-liner programming methods having constrained minimization such as Cutting plane method- Zoutendjik's method- penalty function methods.
4. To study non-liner programming methods having unconstrained minimization such as Fibonacci, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel's method, Newton's method, Davidon Fletcher Powell's method for multivariable optimization.
5. To study linear programming including definitions and theorems, Simplex method, Duality in Linear programming, Plastic analysis and Minimum weight design and rigid frame.
6. To studyquadratic programming, geometric programming and dynamic programming and design of beams and frame using dynamic programming technique.

COURSE OUTCOMES:

Students will get ability

1. Describeneed and scope for optimization, Historical development, Objective function and its surface design variables, constraints and constraint surface, Classification of optimization problems.
2. ExplainClassical optimization techniques, multi variable optimization by method of constrained variation and Lagrange multipliers, Khun-Tucker conditions of optimality
3. Explain non-liner programming methods having constrained minimization such as Cutting plane method- Zoutendjik's method- penalty function methods.
4. Discuss non-liner programming methods having unconstrained minimization such as Fibonacci, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel's method, Newton's method, Davidon Fletcher Powell's method for multivariable optimization.
5. Explain linear programming, definitions and theorems, Simplex method, Duality in Linear programming, Plastic analysis and Minimum weight design and rigid frame.
6. Discuss quadratic programming, Geometric programming and Dynamic programming and design beams and frame using dynamic programming technique.

SYLLABUS:

UNIT-I Introduction: Need and scope for optimization- Historical development – statements of optimization problems- Objective function and its surface design variables- constraints and constraint surface- Classification of optimization problems.

UNIT-II

Classical optimization techniques: Differential calculus method, multi variable optimization by method of constrained variation and Lagrange multipliers and Khun-Tucker conditions of optimality.

UNIT-III

Non-Linear programming: Constrained minimization- Cutting plane method- Zoutendjik's method- penalty function methods.

UNIT-IV

Non-Linear programming: Unconstrained minimization- Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization, Powel's method, Newton's method and Davidson Fletcher Powell's method for multivariable optimization.

UNIT-V

Linear programming: Definitions and theorems- Simplex method- Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame.

UNIT-VI

Introduction to quadratic programming, Geometric programming and Dynamic programming. Design of beams and frame using dynamic programming technique.

Text Books:

1. Optimization Theory and Applications – S.S. Rao, Wiley Eastern Limited, New Delhi
2. Optimum structural design- Theory and applications- R H Gallergher and O C Zienkiewiez3

REFERENCES:

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

Structural Design Lab

COURSE CODE: 22MSE1101

L	T	P	C
0	0	4	2

COURSE OUTCOMES:

Students will get ability to

1. develop the knowledge in design of one story building by staad pro
2. develop the knowledge in design of multistory building by staad pro
3. prepare drawing of the reinforcement details of beam element of the building by autocad and manual
4. prepare drawing of the reinforcement details of footing with column elements of the building by autocad and manual.
5. prepare drawing of the reinforcement details of slab element of the building by autocad and manual.
6. prepare the drawings of reinforcement column, beam joints

SYLLABUS:

1. Design of Single storey building by STAAD Pro v8i
2. Design of multi storey building by STAAD Pro v8i
3. Drawing of beam reinforcement detailing by AutoCAD and Conventional method
4. Drawing of footing and column reinforcement detailing by AutoCAD and Conventional method
5. Drawing of slab reinforcement detailing by AutoCAD and Conventional method
6. Drawing of the column, beam joints by AutoCAD and Conventional method

SOFTWARES :-

1. AUTOCAD

2. STAAD Pro v8i

Advanced Concrete Technology Lab

COURSE CODE: 22MSE1102

L	T	P	C
0	0	4	2

COURSE OUTCOMES:

Students will get ability

1. To practice Tests study of stress strain curve of high strength concrete and Corrolations in between cube and cylinder.
2. To practice Aggregate Crushing and Impact value, Workability Tests on Fresh self compacting concrete, Air Entrainment Test on fresh concrete.
3. To practice Marsh cone test, Permeability of Concrete and effect of cyclic loading on steel.
4. To practice Non Destructive Testing of Concrete, Accelerated Curing of Concrete and behavior of beams under flexure, shear and torsion.
5. To practice Influence of W/C ratio on strength and Aggregate / Cement ratio on workability and Strength, Influence of Different Chemical Admixtures on concrete.

SYLLABUS:

1. Stress – strain response of High Strength Concrete
2. Correlation between cube strength and Cylinder strength
3. Split Tensile strength and Modulus of rupture of Concrete
4. Understanding Cyclic loading on steel reinforcement
5. Workability Tests on Fresh self compacting concrete
6. Air Entrainment Test on fresh concrete.
7. Marsh cone test.
8. Determination of Permeability of Concrete.
9. Non Destructive Testing of Concrete.
10. Accelerated Curing Test of Concrete.
11. Behaviour of RC Beams under Flexure & Shear

Add On Experiments

1. Aggregate Crushing and Impact value
2. Influence of W/C ratio on strength and workability of Concrete
3. Study on Influence of Chemical Admixtures on concrete.

Research Methodology and IPR

COURSE CODE: 22MCC1001

L	T	P	C
2	0	0	2

COURSE OUTCOMES:

On completion of this course, students should be able to

CO 1. Understand research problem formulation.

CO 2. Analyze research related information

CO 3. Follow research ethics

CO 4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO 5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO 6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit I:

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Unit II:

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, an Illustration

Unit III

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed, analysis Plagiarism, and Research ethics.

Unit IV:

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Unit V:

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

Unit VI:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology, Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc, Traditional knowledge Case Studies, IPR and IITs.

Text Books

1. Research methodology by C.R. KOTHARI
2. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Ref. Books

1. Research Methodology, Paneersevam, PHI
2. Research Methodology, Chawla and Sondhi, Vikas
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

English for Research Paper Writing

(Audit Course)

COURSE CODE: 22MAC1001

L	T	P	C
2	0	0	0

Course Objectives

1. To make students understand significance of improving writing skills and level of readability
2. To assist students learn about what to write in each section of their papers
3. To aid students realize importance of reviewing literature for a paper writing
4. To help students acquire skills required for writing a Title, Abstract and Introduction
5. To enable students obtain skills needed when writing methods, results, discussions and conclusions
6. To get students ensure paper is written in the best possible manner

Course Outcomes

1. Students will be able to write paper with clarity and brevity
2. Students will be able to interpret their findings in their own way unaffected by external factors
3. Students will be able to get accurate results with an astute understanding of the subject
4. Students will be able to begin paper writing more aptly
5. Students will be able to write methods, results, discussions and conclusion in their paper more logically
6. Students will be able to use phrases competently to express their ideas

Unit – I

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

Unit – II

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

Unit – III

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

Unit – IV

Key skills needed when writing a Title, an Abstract, an Introduction and a Review of the Literature

Unit – V

Skills needed when writing Methods, Results, Discussions and Conclusion

Unit – VI

Useful phrases, how to ensure paper is as good as it could possibly be the first- time Submission

Text Books

1. Goldbort R (2006). *Writing for Science*. Yale University Press.
2. Day R (2006). *How to Write and Publish a Scientific Paper*. Cambridge University Press.
3. Highman N (1998). *Handbook of Writing for the Mathematical Sciences*, SIAM. Highman's book .

Disaster Management

(Audit Course)

COURSE CODE: 22MAC1002

L	T	P	C
2	0	0	0

Course Objectives

Students will be able to:

1. To understand basic concepts, definitions and Terminologies used in Disaster Management.
2. To Understand Types and Categories of Disasters and its Impact.
3. To promote Prevention and Preparedness for disaster
4. To undertake Mitigation & Risk Reduction steps to prioritize Rescue and Relief operation, Rehabilitation & Reconstruction
5. To understand the seismic zoning of India and various seismic vulnerable locations
6. To know the statistical approach on land slides

Course Outcomes

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

1. Know the Disaster Concepts to Management.
2. Ability to Categorize Disasters & Preparedness plans for disaster response.
3. Ability to analyze seismic vulnerable location in various parts of India
4. Monitoring and evaluation plan for disaster response, setting up of early warning systems for risk reductions
5. Ability to analyze seismic vulnerable location in various parts of India
6. Analyze the statistical approach on land slides

Unit – I

Concept of Disaster Management. Types of Disasters. Disaster mitigating agencies and their organizational structure at different levels

Unit – II

Overview of Disaster situations in India: Vulnerability profile of India and vulnerability mapping including disaster – prone areas, communities, places.

Unit – III

Disaster preparedness – ways and means; skills and strategies; rescue, relief, reconstruction and rehabilitation.

Unit – IV

Case studies: Lessons and experiences from various important disasters in India.

Unit – V

Seismic vulnerability of urban areas.: Seismic response of R.C. frame buildings with soft first storey. Preparedness for natural disasters in urban areas. Sulbh technology for sanitation improvement in urban habitat. Landslide hazards zonation mapping and geo-environmental problems associated with the occurrence of landslides.

Unit – VI

Statistical approach to study landslides: Landslide casual factors in urban areas. Roads and landslide hazards in Himalayas. Lateral strength of masonry walls. A numerical model for post earthquake fire response of structures. Cyclone resistant house for coastal areas. Disaster resistant construction role of insurance sector. Response of buried steel pipelines carrying water subjected to earthquake ground motion. Preparedness and planning for an urban earthquake disaster. Urban settlements and natural hazards. Role of knowledge based expert systems in hazard scenario.

Text Books

1. Natural Hazards in the Urban Habitat" by Iyengar, C.B.R.I., Tata McGraw Hill.
2. Natural Disaster management", Jon Ingleton(Ed), Tulor Rose
3. Disaster Management", R.B. Singh (Ed), Rawat Publications,2006
4. Anthropology of Disaster management", Sachindra Narayan, Gyan Publishing House,2000

Constitution of India

(Audit Course)

COURSE CODE: 22MAC1003

L	T	P	C
2	0	0	0

Course Objectives

Students will be able to:

1. To help Students regulate their behavior in a social environment as Engineering Professionals.
2. To make students aware of the impact of taking social, legal and Administrative decisions about their profession.
3. To understand the political and constitutional parameters in work environment.
4. To understand the need and strengths of our nation and adopt their knowledge for future career.

Course Outcomes:

By the end of this course the student will be able to:

1. Realize the rigidness of our Indian Politics and Administrative aspects.
2. A Student can understand our nation federalism.
3. Can assess different types of risks involved in misadministration.
4. Can create competitive advantage.
5. Summarizes the legal, Administrative, Political and Financial aspects for betterment of the National building.
6. To assess the growth of Indian opinion regarding modern Indian intellectuals' Constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism

Unit – I

Introduction: Historical perspective of the constitution of India - Salient features of The Indian Constitution –Features: Fundamental Rights (Article 12 to 35), Duties (51 A – 1976 emergency) and Directive principles (Article 36 to 51) of State Policy - Articles 14 to 18- Articles 19 - Article 21

Unit-II

Amendment Procedure of The Indian Constitution: 42nd amendment (Mini Constitution) - 44thamendment (1978 – Janatha Govt.)

Unit – III

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

Unit – IV

Parliamentary form of Govt. In India: President of India - Emergency provisions -National Emergency – Article 352 President Rules – Article 356 - Financial Emergency – Article 360Prime Minister and Cabinet - Supreme Court of India (Indian Judiciary)

Unit – V

Indian Federalism: Union – State relations; - Legislative, Administrative and Financial relations. LokSabha, RajyaSabha, VidhanSabha & VidhanParishad - Composition; Speaker, Chairman, Privileges, Legislative procedure.

Unit – VI

Parliamentary Committees: Public Accounts Committee - Estimates Committee - Committee on Public Undertakings. - Election commission of India (Article -324) - Comptrollar and Auditor General (CAG) of India (Article – 148 to 150) - Finance Commission (Article – 280) - NeethiAayog (Planning Commission) and - Political Parties.

Text Books:

1) D.D Basu – Indian Constitution.
2) Dr. D. Surannaidu – Indian PoliticalSystem.
3) MadhavKhosla – The IndianConstitution.

Reference Books:

1)The Constitution of India, 1950 (Bare Act), Government Publication.
2) M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

Personality Development through Life Enlightenment Skills

(Audit Course)

COURSE CODE: 22MAC1004

L	T	P	C
2	0	0	0

Course Outcomes:

On completion of this course, students should be able

1. Realize that everyone is responsible for creating his/her own personality.
2. Gain knowledge of the importance of developing virtues like wisdom and courage and knowing what are good acts (do's) and bad acts (don'ts).
3. Understand the key message of Bhagavad Gita which is experiencing spiritual oneness by practicing any or all of the karma, bhakti, dhyana or raja, and jnana yogas.
4. Know the vedantic perspective of lifewith regards to understanding human nature, art of living and technique of self-unfoldment.
5. Realize the goal and means to attain self-realization which is the only way to attain liberation.
6. Become aware that sub-conscious mind which is full of desires is the main obstacle for self-realization and spiritual practices help in eliminating these desires.

Unit – I

Personality Development: It is Personality that Matters – Laws of Personality Development – Different Layers of Personality – Pleasure is not the Goal – How to Change Our Character – Control Your Negative Emotions – Change Yourself First – Take Whole Responsibility of Yourself.

Unit – II

Holistic Personality Development: (from BhartruhariNeetiSatakam) Wisdom (Verses 19, 20, 21, 22) – Pride & Heroism (Verses 29, 31, 32) – Virtues (Verses 26, 28, 63, 65) – Don'ts (Verses 52, 53, 59) – Do's (Verses 71, 73, 75, 78)

Unit – III

Bhagavad Gita:

Chapter 2 – Verses 17, 56, 62, 68
Chapter 3 – Verses 13, 21, 27, 35, 36, 37, 42
Chapter 4 – Verses 18, 38, 39
Chapter 6 – Verses 5, 13, 17, 23, 35
Chapter 12 – Verses 13, 14, 15, 16, 17, 18
Chapter 18 – Verses 37, 38, 45, 46, 48, 63

Unit – IV

Vedantic Perspective of Life: Brief discussion of major topics in Understanding Human Nature – Art of Living – Technique of Self Unfoldment

Unit – V

Vivekachudamani: Self-realization is the means of liberation – Means to Self-realization – Qualifications of a Spiritual Aspirant – 4-fold Spiritual Discipline

Unit – VI

Mind and Its Mysteries: What is Mind? Mind and body, Mind and food – Mental faculties – Theory of perception, Memory, Imagination, Thought-Culture, Desires – Cultivation of Virtues, Control of Senses and Mind – Concentration, Meditation and Enlightenment.

Text Books

1. Personality Development, Swami Vivekananda, Advaita Ashrama Publication, ISBN 978817552246
2. Three Satakam of Bharatrhari (Niti, Srngara, Vairagya), P. Gopinath, Rashtriya Sanskrit SansthanPubllication.
3. Bhagavad Gita, Swami Swarupananda, Advaita Ashram Publication.
4. Vedanta – Science of Life, 3 Vols, Swami Chinmayananda, Chinmaya Mission Pub (Vol1 – Understanding Human Nature, Vol2 – Art of Living, Vol3 – Technique of Self-Unfoldment)
5. Message of Vivekachudamani, Swami Ranganadhananda, Advaita Ashrama Publication, ISBN 817553089
6. Mind, Its Mysteries and Control, Swami Sivananda, Divine Life Society Publication.

Reference Books:

1. https://archive.org/download/satakasofbhartri00bharuoft/satakasofbhartri00bharuoft.pdf
2. Bhagavad Gita – Sadhaka Sanjivani, Swami Ramsukhdas, Gita Press Publication (1080, 1081)
3. The Goal and The Way, Swami Satprakashananda, Ramakrishna Math Publication
4. Spiritual Quest, Swami Tapasyananda, Ramakrishna Math Publications, ISBN 8171204562
5. Mind According to Vedanta, Swami Satprakashanada, Ramakrishna Math Publication, ISBN 8171206506

FINITE ELEMENT ANALYSIS

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1009

COURSE OUTCOMES:

Students will get ability

1. To study A brief history of F.E.M. Need of the method, Equations of equilibrium, Compatibility, Strain displacement relations.
2. To study and use Theory relating to the formulation of the finite element method, Element Stiffness Matrix and Element Load Vector.
3. To study Application to Structural Elements, Galarkin Method, Interpolation Functions.
4. To study isoparametric formulation, different types of elements and its interpolation functions.
5. To study solve continuum problems using finite element methods into CST,Rectangular and Quadrilateral elements.
6. To study Axi – symmetric element stress analysis and its computations.

COURSE OUTCOMES:
Students will get ability

CO 1: To learn A brief history of F.E.M. Need of the method, Equations of equilibrium, Compatibility, Strain displacement relations.

CO 2: To learn and use Theory relating to the formulation of the finite element method, Element Stiffness Matrix and Element Load Vector.

CO 3: To learn Application to Structural Elements, Galarkin Method, Interpolation Functions.

CO 4: To learn isoparametric formulation, different types of elements and its interpolation functions.

CO 5: To solve continuum problems using finite element methods into CST,Rectangular and Quadrilateral elements.

CO 6: To learn Axi – symmetric element stress analysis and its computations.

UNIT-I

Introduction - A brief history of F.E.M. minimum Potential Energy Principle, Direct Stiffness method, Equilibrium Equations, Assembly of Global Stiffness Matrix, Elements Stress and Strains.

UNIT-II

Beam elements – Element Stiffness Matrix, Element Load Vector and Theory relating to the formulation of the finite element method, Matrix boundary conditions – All with reference to trusses under axial forces.

UNIT-III

Method of Weighted Residuals – Galerkin Finite Element Method, applications to Structural Elements, Compatibility and completeness Requirements, Polynomial Forms and Applications.

UNIT-IV

Types of Elements – Different Types of elements and its shapes with Interpolation functions, Triangular Elements, Rectangular Elements, Three – Dimensional Elements, Isoparametric formulations.

UNIT-V

Application to Solid Mechanics – Plane Stress, Plane Strain, CST Element, Rectangular Element, Iso parametric formulation of the Quadrilateral element.

UNIT-VI

Axi – Symmetric Elements – Axi – Symmetric Elements Stress analysis, Stress and Strain Computations,

TEXT BOOKS:

1. Finite Element Method in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, 1991.
2. Finite Element Analysis , P. Seshu., PHI Learning Private Limited, Delhi, 2013..
3. Finite Element Methods in Engineering, Singiresu S. Rao, ELSEVIER, 5th Edition.
4. Finite element Method by R D Cook

REFERENCES

1. A First Course in the Finite Element Method,Daryl L. Logan, Cengage Learning,5th Edition, 2012.
2. An Introduction to Nonlinear Finite Element Analysis, J N Reddy, Oxford University Press, 2nd Edition, 2015.

Structural Dynamics

COURSE CODE: 22MSE1010

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Students will have

1. To study Objectives, Importance of Vibration Analysis, Nature of ExcitingForces, Mathematical Modeling of Dynamic Systems.
2. To study Degrees of Freedom of continuous system, Oscillatory motion, Simple Harmonic Motion, Free Vibrations of Single Degree of Freedom (SDOF) systems, Undamped and Damped, Critical damping, Logarithmic decrement, Forced vibrations of SDOF systems Harmonic excitation, Dynamic magnification factor, Band width.
3. To study rigid base excitation, Formulation of equations of motion for SDOF and MDOF Systems, Earthquake response analysis of single and multi-storyed buildings, Use of response spectra.
4. To study Free and Forced Vibration with and without Damping-Response to Harmonic Loading- Response to General Dynamic Loading using Duhamel's Integral- Fourier Analysis for Periodic Loading, State Space Solution for Response.
5. To study Selection of the Degrees of Freedom – Evaluation of Structural Property Matrices – Formulation of the MDOF equations of motion - Undamped free vibrations – Solution of Eigen value problem for natural frequencies and mode shapes – Analysis of dynamic response - Normal coordinates
6. To study Dynamic Effects of Wind Loading,Moving Loads Excitation by rigid base translation, Dynamic effects of earthquakes, introduction to earthquake analysis

COURSE OUTCOMES:

Students will get ability

1. To learn Objectives, Importance of Vibration Analysis, Nature of ExcitingForces, Mathematical Modeling of Dynamic Systems.
2. To learn Degrees of Freedom of continuous system, Oscillatory motion, Simple Harmonic Motion, Free Vibrations of Single Degree of Freedom (SDOF) systems, Undamped and Damped, Critical damping, Logarithmic decrement, Forced vibrations of SDOF systems Harmonic excitation, Dynamic magnification factor, Band width.
3. To learn rigid base excitation, Formulation of equations of motion for SDOF and MDOF Systems, Earthquake response analysis of single and multi-storyed buildings, Use of response spectra
4. To learn Free and Forced Vibration with and without Damping-Response to Harmonic Loading- Response to General Dynamic Loading using Duhamel's Integral- Fourier Analysis for Periodic Loading, State Space Solution for Response.
5. To learn Selection of the Degrees of Freedom, Evaluation of Structural Property Matrices – Formulation of the MDOF equations of motion - Undamped free vibrations Solution of Eigen value problem for natural frequencies and mode shapes, Analysis of dynamic response, Normal coordinates.
6. To learn Dynamic Effects of Wind Loading, Moving Loads Excitation by rigid base translation, Dynamic effects of earthquakes, introduction to earthquake analysis

SYLLABUS:

UNIT-I

Introduction: Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems.

UNIT-II

Elements of a Vibratory system: Degrees of Freedom of continuous systems, Oscillatory motion, Simple Harmonic Motion, Free Vibrations of Single Degree of Freedom (SDOF) systems, Undamped and Damped, Critical damping, Logarithmic decrement, Forced vibrations of SDOF systems, Harmonic excitation, Dynamic magnification factor, Band width.

UNIT-III

Dynamic Analysis: Introduction, Rigid base excitation, Formulation of equations of motion for SDOF and MDOF Systems, Earthquake response analysis of single and multi-storyed buildings, Use of response spectra

UNIT-IV

Single Degree of Freedom System: Free and Forced Vibration with and without Damping- Response to Harmonic Loading- Response to General Dynamic Loading using Duhamel's Integral- Fourier Analysis for Periodic Loading, State Space Solution for Response.

UNIT-V

Multiple Degree of Freedom System (Lumped parameter): Selection of the Degrees of Freedom – Evaluation of Structural Property Matrices – Formulation of the MDOF equations of motion - Undamped free vibrations – Solution of Eigen value problem for natural frequencies and mode shapes – Analysis of dynamic response - Normal coordinates

UNIT-VI

Special Topics in Structural Dynamics(Concepts only): Dynamic Effects of Wind Loading, Moving Loads Excitation by rigid base translation, Dynamic effects of earthquakes, introduction to earthquake analysis

REFERENCES:

1. Dynamics of Structures by Claugh&Penzien.
2. Structural Dynamics A K Chopra
3. Vibration of Structures - Application in Civil Engineering Design, Smith J. W., Chapman and Hall.
4. Structural Dynamics - Theory and Computation, Paz Mario, CBSPublication. Dynamics of Structures, Hart and Wong

Advanced Steel Design
(Elective-3)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1011

COURSE OBJECTIVES:

Students will have

1. To study Limit analysis of steel structures, Mechanical properties of structural steel, Plastic hinge, Moment curvature relations, Upper lower bound theorems. Redistribution of moments.
2. Various types of connections
3. Plastic method of structural analysis
4. General principle in the design of steel structures
5. To study Design of Steel Towers ,Steel transmission line towers
6. Analysis and design of industrial structures

COURSE OUTCOMES:

Students will get ability

1. To learn Limit analysis of steel structures, Mechanical properties of structural steel, Plastic hinge, Moment curvature relations, Upper lower bound theorems. Redistribution of moments.
2. Analyze various types of connections like bearing type joints - unstiffened & stiffened seat connections -moment resisting connection -bolted and welded-semi-rigid connections.
3. Analyze & Application of Theory of plastic bending - Plastic hinge concept.
4. Analyze General principle in the design of steel structures
5. Analyze & design of free standing and guyed towers-loads on towers Tower.
6. Analyze Industrial buildings, Gable frames with gantry girder industrial frames-Fire resistant design-Fatigue resistant design.

UNIT I

Limit analysis of steel structures: Mechanical properties of structural steel, Plastic hinge, Moment curvature relations, Limit load, Coplanar load, Upper lower bound theorems. Redistribution of moments continuous beams: Relevant or irrelevant mechanisms, Types of mechanisms method for performing moment check.

UNIT II-CONNECTIONS

Properties of Steel: Mechanical Properties, Hysteresis, Bearing type joints - unstiffened and stiffened seat connections -moment resisting connection of brackets-bolted and welded-semi-rigid connections, Location of Beam Column, Column Foundation, Splices.

UNIT III-PLASTIC ANALYSIS

Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.

Design of Steel Structures: Theory of plastic bending –Shape Factor- Plastic hinge concept ,Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift.

UNIT IV-GENERAL PRINCIPLES

Ductility, Beams subjected to biaxial bending - Built-up Purlins - Various types and Design - Design of Wind girders-Beam-columns - With various support Conditions-Design of foundations-with lateral forces.

UNIT V-TOWERS

Basic structural configurations - free standing and guyed towers-loads on towers Towers - wind loads - foundation design - design criteria for different configurations and transmission line towers.

UNIT VI-INDUSTRIAL BUILDINGS

Industrial buildings-braced and unbraced - Gable frames with gantry girder industrial frames-Fire resistant design-Fatigue resistant design.

Text Books:

1. N.Subramanian, *"Design of Steel Structures: Theory and Practice"*,Oxford university Press, U.S.A, Third Edition, 2011
2. Duggal.S.K, *"Design of Steel Structures"*, McGraw Hill New Delhi,2010
3. Dayaratnam P. *"Design of Steel Structures,"*S. Chand Limited, NewDelhi. 2008
4. Neal. B.G., *"Plastic Method of Structural Analysis"*, Taylor &Francis,Third Edition, 1985
5. Edwin.H.Gaylord, Charles.N.Gaylord, James. E. Stallmeyer, *"SteelStructures"*, McGraw Hill, New Delhi, 1980.
6. Ramchandra, *"Design of Steel Structures"*, Vol I & II Standard BookHouse, Delhi, 1975
7. Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.

Reference Books:

1. John E. Lothers, *"Structural Design in Steel"*, Prentice Hall, 1999.
2. Neal. B.G., *"Plastic Method of Structural Analysis"*, Taylor &Francis,Third Edition, 1985
3. Arya.S and Ajmani.J.L, *"Design of Steel Structures"*, Nem Chand &Bros, Roorkee.
4. The Steel Skeleton- Vol. II, Plastic Behaviour and Design - Baker J. F., Horne M. R., Heyman J., ELBS.
5. IS 800: 2007 – General Construction in Steel - Code of Practice,2007.
6. SP – 6 - Handbook of Structural Steel Detailing, BIS,1987.

Design of Formwork
(Elective-3)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1012

Course Objectives: At the end of the course, students will be learning to

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

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

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

Syllabus Content:

UNIT-I

Introduction: Definition of Form Work, Difference between Form Work and False Work, Requirements and Selection of Formwork, Difficulties while Erection

UNIT-II

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

UNIT-III

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

UNIT-IV

Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

UNIT-V

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

UNIT-VI

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

Reference Books:

Formwork for Concrete Structures, Purify, Mc Graw Hill India, 2015.
Formwork for Concrete Structures, Kumar Neeraj Jha, Tata McGraw Hill Education, 2012.
IS 14687: 1999, false work for Concrete Structures - Guidelines, BIS.

Design of High Rise Structures
(Elective-3)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1013

COURSE OBJECTIVES:

Students will have

1. To study Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, wind pressures and forces in buildings/structures, External pressure coefficients for various roofs, dynamic effects.
2. To study Analysis of Multistory Building Frames for lateral loads, Cantilever method, Portal method and Factor method.
3. To study Types of shear walls, Behavior of cantilever wall with rectangular cross-section, flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid joined frames, Shear walls with openings, Coupled shear walls.
4. To study Wind pressure, Stress in chimney shaft due to self-weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference. Design of RC chimney.
5. To study Differences between bunker and silo, Design of square or rectangular bunkers, Design of circular bunkers, Design of silos, Silos for storage of cement.
6. To study Analysis of multistory frames, Method of substitute frames, Bending moments in beams and columns.

COURSE OUTCOMES:

Students will get ability

1. To learn Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, wind pressures and forces in buildings/structures, External pressure coefficients for various roofs, dynamic effects.
2. To learn Analysis of Multistory Building Frames for lateral loads, Cantilever method, Portal method and Factor method.
3. To learn Types of shear walls, Behavior of cantilever wall with rectangular cross-section, flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid joined frames, Shear walls with openings, Coupled shear walls.
4. To learn Wind pressure, Stress in chimney shaft due to self-weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference. Design of RC chimney.
5. To learn Differences between bunker and silo, Design of square or rectangular bunkers, Design of circular bunkers, Design of silos, Silos for storage of cement.
6. To learn Analysis of multistory frames, Method of substitute frames, Bending moments in beams and columns.

SYLLABUS:

UNIT-I

Wind Loads on Structures: Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, wind pressures and forces in buildings/structures, External pressure coefficients for various roofs, dynamic effects.

UNIT-II

Lateral load Analysis of Multistory Building Frames: Analysis of Multistory Building Frames for lateral loads, Cantilever method, Portal method and Factor method

UNIT-III

Design of Shear Wall: Introduction, Types of shear walls, Behavior of cantilever wall with rectangular cross-section, flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid joined frames, Shear walls with openings, Coupled shear walls.

UNIT-IV

Design of Chimneys (RCC): Introduction, Wind pressure, Stress in chimney shaft due to self-weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference. Design of RC chimney.

UNIT-V

Bunkers and Silos: Introduction, Differences between bunker and silo, Design of square or rectangular bunkers, Design of circular bunkers, Design of silos, Silos for storage of cement.

UNIT-VI

Multistory Building Frames: Analysis of multistory frames, Method of substitute frames, Bending moments in beams and columns.

REFERENCES:

1. "Reinforced Concrete Structures" by Park, R. & Paulay, T.
2. "Advanced Reinforced Concrete Design", byN. Krishna Raju
3. "Reinforced Concrete Structures" by Punmia, Jain & Jain.
4. "Tall Chimneys" by Manohar, S.N.
5. "Design of Steel Structures" byN.Subramanian

Design of Advanced Concrete Structures
(Elective-4)

COURSE CODE: 22MSE1014

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To study the deformations, Characteristic Imposed loads, Wind loads on structures, Indian Code for wind loads and wind load combination.
2. To study the Short term deflection of beams and slabs due to imposed loads & applied loads,
3. To study the redistribution of Moments in Reinforced concrete beams Introduction, Moment-curvature (M - ψ), Relation of reinforced concrete sections
4. To study the Minimum thickness, Steps of designing deep beams, Design of deep beams by IS 456, Checking for local failures.
5. To study the Classification of shear walls, Loads in shear walls, Design of rectangular shear wall, Design of Flanged shear walls, Derivation of formula for moment resistance of rectangular shear wall.
6. To study the Reinforcement detailing of Slabs, Beams, Columns, Deep beams, Corbels

COURSE OUTCOMES:

CO-1 To learn the deformations, Characteristic Imposed loads, Wind loads on structures, Indian Code for wind loads and wind load combination.
CO-2 To learn the Short term deflection of beams and slabs due to imposed loads & applied loads,
CO-3 To study the redistribution of Moments in Reinforced concrete beams Introduction, Moment-curvature (M - ψ), Relation of reinforced concrete sections
CO-4 To learn the Minimum thickness, Steps of designing deep beams, Design of deep beams by IS 456, Checking for local failures.
CO-5 To learn the Classification of shear walls, Loads in shear walls, Design of rectangular shear wall, Design of Flanged shear walls, Derivation of formula for moment resistance of rectangular shear wall.
CO-6 To learn the Reinforcement detailing of Slabs, Beams, Columns, Deep beams, Corbels

SYLLABUS:

UNIT-I : Loads and Material characteristics: Dead Loads, imposed loads, loads due to imposed deformations, Characteristic Imposed loads, Partial Safety factors for loads, Provisions for Live loads, Wind loads on structures, Indian Code for wind loads and wind load combination.

UNIT-II: Deflection: Short term & Long Term Deflections of beams, Calculation of Deflection as per the provisions of IS 456.

Crack width: Factors affecting crack-width in beams, Mechanism of Flexural Cracking, Calculations of Crack width as per provisions of IS 456.'

UNIT-III: Moment Redistribution: Introduction, Redistribution of moments in fixed beam, Positions of points of contra flexure, Conditions for moment redistribution, Final shape of redistributed bending moment diagram, Moment redistribution for a two-span continuous beam, Modification of clear distance between bars in beams (for limiting crack width) with redistribution, IS code provisions- Moment-curvature (M - ψ), Relation of reinforced concrete sections.

UNIT-IV: Design of RC deep beams & Corbels: Strut-and-tie Mechanism,Minimum thickness, Steps of designing deep beams, Design of deep beams and Corbels by IS 456, Check for local failures.

UNIT-V: Design of shear walls: Classification of shear walls, Loads in shear walls, Design of rectangular shear wall, Design of Flanged shear walls, Derivation of formula for moment resistance of rectangular shear wall.

UNIT-VI: Add Yield Line Theory of RC Slabs: Analysis and Design of regular slabs, yield line pattern of irregular slabs

Text Books:

1. "Advanced Reinforced Concrete" P.C. Varghese vol:2 Prentice Hall of INDIA Private Ltd. 2008.
2. "Reinforced Concrete Design" CK Wang

Reference Books:

1. "Design of Reinforced Concrete Structures" by N.Subramanian, Oxford University Press.
2. "Reinforced Concrete Design" S. Unnikrishna Pillai & Devdas Menon; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.
3. Reinforced concrete structural elements – behaviour, Analysis and design by P. Purushotham, Tata Mc.Graw-Hill, 1994.
4. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
5. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
6. "Design Reinforced Concrete Foundations" P.C. Varghese Prentice Hall of INDIA Private Ltd.
7. IS 456-2000 10. SP 16 11. SP 34, IS 13920-2016

Advanced Design of Foundations
(Elective-4)

COURSE CODE: 22MSE1015

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
Students will have

1. To Decide the suitability of soil strata for different projects.
2. To Design shallow foundations deciding the bearing capacity of soil..
3. To Analyze and design the pile foundation.
4. To Understand analysis methods for well foundation.
5. To Compute Pressure around Tunnels.
6. To design pressed steel water tank and its foundation.

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

1. Decide the suitability of soil strata for different projects.
2. Design shallow foundations deciding the bearing capacity of soil.
3. Analyze and design the pile foundation.
4. Understand analysis methods for well foundation.
5. Compute Pressure around Tunnels.
6. Analysis and Design, Foundations under uplifting loads.

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

UNIT-II: Shallow Foundations, Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity-Terzaghi,meyarhoff,vesic and IS methods, Settlements of Footings.

UNIT-III: Pile Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles. Pile caps

UNIT-IV: Well Foundation, IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods.

UNIT-V: Tunnels and Arching in Soils, Pressure Computations around Tunnels.

UNIT-VI:Open Cuts, Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types.Coffer Dams, Various Types, Analysis and Design, Foundations under uplifting loads.

Reference Books:

1. Foundation Analysis and Design, J. E. Bowles, Tata McGraw Hill New York

Design of foundation system, N.P. Kurian, Narosa Publishing House.
2. 3. Analysis and Design of Substructures, Sawmi Saran, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi

Design of Industrial Structures
(Elective-4)

COURSE CODE: 22MSE1016

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Students will have

1. To analyze and design steel gantry girders.
2. To design portal frame with hinge base, design of portal frame with fixed base, gable structures and lightweight structures.
3. To design square bunker using Jansen's and Airy's theories and is codeprovisions, cylindrical silo.
4. To design chimneys and its foundation.
5. To design rectangular riveted steel water tank and its foundation.
6. To design pressed steel water tank and its foundation.

COURSE OUTCOMES:

Students will get ability

1. Analyze and design steel gantry girders.
2. Design portal frame with hinge base, design of portal frame with fixed base, Gable Structures and Lightweight Structures.
3. Design square bunker using Jansen's and Airy's theories and IS Codeprovisions, cylindrical silo.
4. Design chimneys and its foundation.
5. Design rectangular riveted steel water tank and its foundation.
6. Design pressed steel water tank and its foundation

SYLLABUS:

UNIT-I

Steel Gantry Girders : Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.

UNIT-II

Portal Frames : Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures –Lightweight Structures.

UNIT-III

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

UNIT-IV

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

UNIT-V

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

UNIT-VI

Design of pre-stressed steel water tank:Design of stays ,Joints ,Design of hemispherical bottomwater tank ,side plates ,Bottom plates , joints , Ring girder ,Design of staging and foundation.

Textbook Books:

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

Reference Books:

- "Fundamentals of Structural Analysis" by Jakkula & Stephenson, Von Nostrand, East West Press.
- "Design of Steel Structures" by Arya & Ajmani, Nemchand Publishers

Design of Pre Stressed Concrete Structures
(Elective-5)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1017

COURSE OBJECTIVES:

Students will have

1. to study about historic development, methods and systems of prestressed concrete and IS code provisions.
2. to study about loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete etc,
3. to study analysis of sections for flexure with straight, concentric, eccentric, bent and parabolic tendons.
4. to study about design of various sections for flexure and Shear and analysis of end blocks which include Guyon's method and Mugnel method
5. to study about composite section which include analysis of stress , differential shrinkage and deflections of prestressed concrete beams.
6. to study P-line, C-line – primary moment – secondary moment – analysis and design of continuous beams

COURSE OUTCOMES:

Students will get ability

1. Describe general principles and various methods of pre-stressed concrete.
2. Identify the losses of the prestresses due to various causes.
3. Analyze sections for flexure with straight, concentric, eccentric, bent and parabolic tendons.
4. Design of Sections for Flexure and Shear, analyze the end blocks by different methods.
5. Analyze stresses and compute shrinkage of composite sections and Compute Deflections of Pre-stressed Concrete Beams.
6. Analyze continuous beamsand design of continuous beams

UNIT – I

Introduction: Principles of pre-stressing- pre-tensioning and post tensioning – Materials – High strength concrete and high Strength steel- I.S. 1343 provisions, Pre-tensioning and post tensioning methods - Different systems of pre-stressing (Hoyer System, Magnel System, Freyssinet system and Gifford – Udall System).

UNIT – II

Losses of Pre-stress: Loss of prestress in pre-tensioned and post-tensioned members- elastic shortage of concrete- shrinkage of concrete- creep of concrete-Relaxation of steel-slip in anchorage bending of member-frictional losses.

UNIT – III

Analysis of Flexural members: Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons.

UNIT – IV

Design for Flexure and Shear: Design as per I.S. 1343 – simple rectangular and I-section and principal stresses – Kern lines, cable profile.

Analysis of End Blocks: Guyon's method and Mugnel method, Anchorage zone stresses – As per IS 1343 – Anchorage zone reinforcement – Transfer of prestress pre-tensioned members.

UNIT – V

Composite section: Analysis of stresses and design considerations.

Deflections of Prestressed Concrete Beams: Control of deflections –Influencing factors– short term & long term deflections of uncracked members

UNIT – VI

Continuous beams: P-line, C-line – primary & secondary moments – analysis and design of continuous beams

Text Books:

1. Prestressed Concrete by Krishna Raju; - Tata Mc.Graw Hill Publications 2018
2. . Design of Prestressed concrete structures (Third Edition) by T.Y. Lin & Ned H.Burns, John Wiley & Sons.
3. Prestressed Concrete by Ramamrutham; Dhanpat rai Publications 2016.

References:

12. Pre-Stressed Concrete byMuttu & Janarthan

Codes: Code of Practice for IS 1343 - 1980

Note: Code book is permitted to the examination

Prefabricated Structures
(Elective-5)

L	T	P	C
3	0	0	3

COURSE CODE: 22MSE1018

COURSE OBJECTIVES:

1. To study the need and principles of prefabrication
2. To study the behavior of prefabricated structural components.
3. To study the design of cross sections of prefabricated structures.
4. To study the design of expansion joints
5. To study the applications of pre-stressing of roof members
6. To study the effects of abnormal loads.

COURSE OUTCOMES:

After successful completion of this course, students will be able to:

CO 1: Illustrate the need and principles of prefabrication
CO 2: Determine the behavior of prefabricated structural components
CO 3: Design cross sections of prefabricated elements
CO 4: Design joints for different structural members
CO 5: Apply the concept of pre-stressing in roof members.
CO 6: Design structural members subjected to abnormal loads

UNIT - I
INTRODUCTION

Need for prefabrication – Principles – Materials – Modular coordination – Standarization – Systems – Production – Transportation – Erection.

UNIT - II
PREFABRICATED COMPONENTS

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

UNIT - III
DESIGN PRINCIPLES

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT - IV
JOINT IN STRUCTURAL MEMBERS

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

UNIT - V
APPLICATION OF PRESTRESSING OF ROOF MEMBERS

Floor systems two way load bearing slabs, Wall panels, hipped plate and shell structures

UNIT - VI
DESIGN FOR ABNORMAL LOADS

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TEXT BOOKS:

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., "Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

REFERENCES:

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

Fracture Mechanics of Concrete
(Elective-5)

COURSE CODE: 22MSE1019

L	T	P	C
3	0	0	3

Course Objectives: At the end of the course, students will be able to
1. To Study the Crack in a Structure, Mechanisms of Fracture
2. To Study the classification of cracking in concrete structures based on fracture mechanics.
3. To learn the Implement stress intensity factor for notched members
4. To Study the fracture mechanics models to high strength concrete and FRC structures.
5. To Study the J-integral for various sections understanding the concepts of LEFM.
6. To learn High Strength Concrete, Fiber Reinforced Concrete.

Course outcomes: At the end of the course, students will be able to
1. Understand the Crack in a Structure, Mechanisms of Fracture
2. Identify and classify cracking of concrete structures based on fracture mechanics.
3. Implement stress intensity factor for notched members
4. Apply fracture mechanics models to high strength concrete and FRC structures.
5. Compute J-integral for various sections understanding the concepts of LEFM.
6. Applications to High Strength Concrete, Fiber Reinforced Concrete.

Syllabus:

UNIT - I:

Introduction: Damage Tolerance Analysis, Fracture at atomic level, Bond strength and Bond Energy,

UNIT - II:

Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.

UNIT - III:

Stress at Crack Tip: Analysis of Members for Discontinuities (Inglis Approach) Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, and Stress Intensity Factors.

UNIT - IV:

Crack Tip Plastic Zone, Irwin's and Dugdale Plastic Zone Correction, R-curves, Compliance, J-Integral, CTOD, CMOD

UNIT - V:

Material Models: Reasons for fracture Mechanics of Concrete, Fracture process zone, Modeling of Fracture process zone- Fictitious Crack model, Crack Band model, Two parameter fracture model, Effective Crack Model and Size effect model., Introduction to Damage Mechanics.

UNIT - VI:

Applications to Concrete Dams, Lightly Reinforced RC beams and Non-Linear Modeling of Concrete (Numerical Modeling).

Reference Books:

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

Numerical Analysis Lab

COURSE CODE: 22MSE1103

L	T	P	C
0	0	4	2

Course Objectives: At the end of the course, students will be learn to

1. To develop basic knowledge on usage of MAT LAB to solve engineering problems.
2. Find Roots of non-linear equations by Bisection method and Newton's method.
3. Do curve fitting by least square approximations
4. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method
5. To Integrate Numerically Using Trapezoidal and Simpson's Rules
6. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Kutta Method

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

1. To develop basic knowledge on usage of MAT LAB to solve engineering problems.
2. Find Roots of non-linear equations by Bisection method and Newton's method.
3. Do curve fitting by least square approximations
4. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method
5. To Integrate Numerically Using Trapezoidal and Simpson's Rules
6. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Kutta Method

Syllabus Contents:

Exercises:

1. Write a MAT LAB Code for finding the Roots of Non-Linear Equation Using Bisection Method.
2. Write a MAT LAB Code for finding the Roots of Non-Linear Equation Using Newton's Method.
3. Write a MAT LAB Code for solving the Curve Fitting by Least Square Approximations.
4. Write a MAT LAB Code for solving the System of Linear Equations Using Gauss - Elimination Method.
5. Write a MAT LAB Code for solving the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Write a MAT LAB Code for solving the System of Linear Equations Using Gauss - Jorden Method.
7. Write a MAT LAB Code to Integrate numerically using Trapezoidal Rule. Integrate numerically using Simpson's Rules.
8. Write a MAT LAB Code for finding Numerical Solution of Ordinary Differential Equations by Euler's Method.
9. Write a MAT LAB Code for finding Numerical Solution of Ordinary Differential Equations by Runge - Kutta Method.

TEXT BOOKS:

1. Introduction to Numerical Methods, A MAT LAB Approch, Abdelwahab Kharab, Ronald B Guenther, Chapman & CRC Press.
2. Simulink User Manual, Mathworks Corporation.
3. MAT LAB Toolboxes Introduction, Mathworks Corporation

REFERENCE BOOKS:

Chapman S.J. Essentials of MAT LAB Programming (CENGAGE Leaning, 2nd ed., 2008)

Industrial Safety

(Open Elective)

COURSE CODE: 22MOE1001

L	T	P	C
3	0	0	3

Course Outcomes:

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

1. Understand the types, causes and preventive steps of mechanical and electrical hazards.
2. Identify types of maintenance and apply relevant tools of maintenance.
3. Understand the types, causes, applications of wear and types and prevention methods of corrosion
4. Understand the concepts of fault tracing and decision tree for different machine tools
5. List the applications of periodic maintenance.
6. Illustrate the applications of preventive maintenance.

Unit – I

Industrial safety:

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

Unit – II

Fundamentals of maintenance engineering

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

Unit – III

Wear and Corrosion and their prevention

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit – IV

Fault tracing

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

Unit – V

Periodic and preventive maintenance

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

Unit – VI

Procedure for periodic and preventive maintenance

Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. MaintenanceEngineeringHandbook,Higgins&Morrow,DaInformationServices.
2. Maintenance Engineering, H.P.Garg, S.Chandand Company.

Reference Books:

1. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
2. FoundationEngineeringHandbook,Winterkorn,Hans,Chapman&HallLondon.

Operations Research

(Open Elective)

COURSE CODE: 22MOE1002

L	T	P	C
3	0	0	3

Course Outcomes

On completion of this course, students should be able to

1. Formulate, solve linear programming problem using graphical and simplex method along with its Big-M and 2-Phase variations.
2. Solve both balanced and unbalanced transportation and assignment problems.
3. Students should able to apply the concept of non-linear programming
4. Compute queue performance characteristics for various queuing models.
5. Solve game theory problems by applying standard solution methods.
6. Calculate critical path for a given network using PERT and CPM techniques.

Unit – 1

Linear Programming: Introduction to linear programming problem formulation, Graphical solution, Simplex method, Artificial variables techniques, Degeneracy.

Unit – II

Transportation Problem: Formulation, Optimal solution, unbalanced transportation problems, Degeneracy. Assignment Problem: Formulation, Optimal solution, Traveling salesman problem.

Unit - III

Nonlinear Programming Problems: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem.

Unit – IV

Queuing Theory: Characteristics of Queuing models, Classification, (M/M/1):(FCFS/∞/∞), (M/M/1):(FCFS/N/∞), (M/M/C):(FCFS/∞/∞) models.

Unit – V

Theory of Games: Introduction, Two-person Zero-sum games, Maximum-Minimax principle, Games without saddle points, Mixed Strategies, m x 2 & 2 x n games, Graphical solutions, Dominance property, Algebraic solutions to rectangular games.

Unit – VI

Network models: Project network, CPM and PERT, Critical path scheduling, Cost considerations in project scheduling.

Text Books:

1. Introduction to Operations Research by Prem Kumar Gupta, D.S. Hira, S. Chand Publishers
2. Operations Research, S.D.Sharma, Kedarnath Ramanadh Pub.

References Books:

1. Operations Research, J.K. Sharma, MacMilan Pub.
2. Operations Research by P. Rama Murthy, New Age Pub.
3. CPM & PERT, L.S. Srinath, Affiliated East West Press Pu

Composite Materials

(Open Elective)

COURSE CODE: 22MOE1003

L	T	P	C
3	0	0	3

Course Outcomes:

On completion of this course, students should be able to

1. Illustrate the concept and classification of composites
2. Understand fundamental fabrication processes for polymer matrix,
3. Analyze the strengthening mechanism and structural effect on properties of composite materials.
4. Understand the fundamental concepts of metal matrix, and ceramic matrix composites
5. Understand and Predict elastic properties of long fiber and short fiber composites.
6. Design different types of composite by apply the micromechanics principles.

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

Unit – II Reinforcements and the reinforcement matrix interface: natural fibers; synthetic organic fibers – aramid, polyethylene; and synthetic inorganic fibers – glass, alumina, boron, carbon, silicon based fibers; particulate and whisker reinforcements, reinforcement-matrix interface – wettability, interfacial bonding, and methods for measuring bond strength.

Unit – III Metal Matrix Composites: Introduction, important metallic matrices; metal matrix composite processing: solid state processing – diffusion bonding, powder metallurgy; liquid state processing – melt stirring, compocasting (rheocasting), squeeze casting, liquid infiltration under gas pressure; deposition – spray co-deposition and other deposition techniques like CVD and PVD; in situ processes. Interface reactions.

Properties of MMCs – physical properties; mechanical properties like elastic properties, room temperature strength and ductility, properties at elevated temperatures, fatigue resistance.

Unit – IV Ceramic Matrix Composites: Introduction; processing and structure of monolithic materials – technical ceramics, glass-ceramics. Processing of ceramics: conventional mixing and pressing – cold pressing and sintering, hot pressing, reaction bonding processes, techniques involving slurries, liquid state processing – matrix transfer moulding, liquid infiltration, sol-gel processing, vapour deposition techniques like CVD, CVI, liquid phase sintering, lanxide process and in situ processes. Processing, properties and applications of alumina matrix composites - SiC whisker reinforced, zirconia toughened alumina; Glass-ceramic matrix composites; Carbon-carbon composites - porous carbon-carbon composites, dense carbon-carbon composites.

Unit – V Polymer Matrix Composites: Introduction; polymer matrices – thermosetting, thermoplastic, rubbers. Processing of PMCs , Processing, properties and applications of fibre-reinforced epoxies, PEEK matrix composites, rubber matrix composites. Damping characteristics. Environmental effects in polymer matrix composites. Recycling of PMCs.

Unit – VI Micromechanics of unidirectional composites: micromechanics models for stiffness – longitudinal stiffness, transverse stiffness, shear modulus, Poisson's ratio.

Text Books:

1. Composite Materials: Engineering and Science, by Matthews and Rawlings, CRC Press.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. Composite Materials Science and Engineering, K.K.Chawla, Springer.
2. An Introduction to composite material, by D.Hull and T.W. Clyne, Cambridge University press.
3. Metal Matrix Composites, Thermomechanical Behaviour by M.Taya, and R.J.Arsenault, Pergamon Press, Oxford.
4. Fundamentals of Metal Matrix Composites by S.Suresh, A.Martensen, and A.Needleman, Butterworth, Heinemann
5. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.

Waste to Energy

(Open Elective)

COURSE CODE: 22MOE1004

L	T	P	C
3	0	0	3

Course Objective:

To deal with various types of wastes generated in the contemporary world and technological options of their exploitation for obtaining useful energy, minimization of wastes.

Course Outcomes:

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

CO 1. Diagnosis the different wastes and their conversion devices.

CO 2. Assess the diverse pyrolysis types of biomass and production methods of different fuel oils.

CO 3. Evaluate the gasification methods of biomass, their design, construction and operation.

CO 4. Suggest the combustion processes of biomass, their design, construction and operation.

CO 5. Analyze the types of biogas plants,

CO 6. Design and develop the biomass conversion processes.

Unit-I

Introduction to Energy from Waste: Classification and Characterization of waste as fuel – Agro based, Forestresidue, Industrial waste – Municipal Solid Waste Conversion devices – Incinerators, gasifiers, digesters.

Unit-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications- Oil from waste plastics - Alcohol production from biomass - Bio diesel production.

Unit-III

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

Unit-IV

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

Unit-V

Biogas: Properties of biogas (Calorific value and composition) - Types of biogas Plants – Applications - Technologyand status of Biogas plants - Bio energy system - Design and constructional features – Biomass energy program in India.

Unit – VI

Biomass: Biomass resources and their classification - Biomass conversion processes – Thermo-chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Urban waste to energy conversion.

Suggested Books:

1. Rogoff, M.J. and Screve, F., "Waste-to-Energy: Technologies and Project Implementation", Elsevier Store - Reprint - 2011.
2. Hall, D.O. and Overeed, R.P.," Biomass - Renewable Energy", John Willy and Sons – Reprint - 1987.
3. Harker, J.H. and Backhusrt, J.R., "Fuel and Energy", Academic Press Inc – Reprint - 1981.
4. EL-Halwagi, M.M., "Biogas Technology- Transfer and Diffusion", Elsevier Applied Science – Reprint - 1984.

References:

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

Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

4.Mondal, P. and Dalai, A., "Utilization of natural resources", CRC Press – Published – 2017.

5.Young G.C., "Municipal Solid Waste to Energy Conversion processes", John Wiley and Sons – Reprint – 2010.