Viswam Engineering College

(AUTONOMOUS)

Angallu Post, Madanapalli, Annamayya , Andhra Pradesh - 517325, India.

M.TECH. IN MACHINE DESIGN

COURSE STRUCTURE & SYLLABI

Under R24 Regulations

(Applicable for 2024-2025 Regular Students)

Department of Mechanical Engineering

DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech R24 - COURSE STRUCTURE

SEMESTER – I

S. No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	B11501	Computational Methods	PC	3	0	0	3
2.	B11502	Advance Finite element methods	PC	3	0	0	3
3.	B11503 B11504 B11505	**Program Elective Course - I** Advanced Mechanisms Computer Applications in DesignMaterials Technology	PE	3	0	0	3
4.	B11506 B11507 B11508	**Program Elective Course -II** Advanced Mechanics of Solids Tribology in Design Gear Engineering	PE	3	0	0	3
5.	B11509	Numerical Simulation Laboratory	PC	0	0	4	2
6.	B11510	Advanced Computer Aided Design Lab	PC	0	0	4	2
7.	B1MC01	Research Methodology and IPR	MC	2	0	0	2
8.	B1AC01 B1AC02 B1AC03	**Audit Course – I** English for Research paper writingDisaster Management Sanskrit for Technical Knowledge	AC	2	0	0	0
Total							**18**

SEMESTER – II

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	B11511	Advanced Optimization Techniques	PC	3	0	0	3
2.	B11512	Fracture fatigue and creep deformation	PC	3	0	0	3
3.	B11513 B11514 B11515	**Program Elective Course – III** Industrial Robotics and Expert Systems Experimental Stress Analysis Theory of Plasticity	PE	3	0	0	3
4.	B11516 B11517 B11518	**Program Elective Course – IV** Mechanical Vibrations Design For Manufacturing Pressure Vessel Design	PE	3	0	0	3
5.	B11519	Machine Dynamics Laboratory	PC	0	0	4	2
6.	B11520	Modelling and Analysis Lab	PC	0	0	4	2
7.	B11521	Technical seminar	PR	0	0	4	2
8.	B1AC04 B1AC05 B1AC06	**Audit Course – II** Pedagogy Studies Stress Management for Yoga Personality Development through Life Enlightenment Skills	AC	2	0	0	0
		Total					**18**

Viswam Engineering College
Autonomous Institution
Approved by AICTE, New Delhi, Affiliated to JNTU, Anantapur,Accredited by NAAC with 'A' Grade,
Certified by ISO 9001:2008 & Recognised by UGC Under Section 2(f), Government of India.
Angallu, Madanapalle, Annamayya Dist. Andhra Pradesh 517325.

Department of Mechanical Engineering

I Year M.Tech. MD – I Semester

Code: B11501	**COMPUTATIONAL METHODS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Students will demonstrate aptitude in standard numerical techniques for solving various classes of problems.
- Students will learn the theory underlying the derivation of standard numerical techniques and the development of algorithms.
- Modeling of engineering problems drawn from different disciplines of mechanical engineering

Course Outcomes (CO):

- Student will be able to enable students to formulate and solve engineering problems that are not enable to analytical methods.
- To demonstrate the application of numerical methods to data analysis and optimal design.

UNIT – I

Introduction to numerical methods applied to engineering problems: Examples, solving sets of equations – Matrix notation – Determinants and inversion – Iterative methods – Relaxation methods System of non-linear equations – computer programs

Numerical integration: Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration

UNIT – II

Optimization: One dimensional unconstrained optimization, multidimensional unconstrained optimization –direct methods and gradient search methods, constrained optimization

Boundary value problems and characteristic value problems: Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method – Characteristic value problems.

UNIT – III

Numerical solutions of partial differential equations: Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness –ADI method – Finite element method.

UNIT – IV

boundary condition – Stability and convergence criteria – Finite element for heat flow – computer programs.

Hyperbolic partial differential equations: Solving wave equation by finite differences-stability of numerical method –method of characteristics-wave equation in two space dimensions-computer programs.

UNIT - V

Curve fitting and approximation of functions: Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, non linear regression - computer programs.

Textbooks:

1. "Numerical Methods for Engineers", Steven C.Chapra, Raymond P.Canale Tata Mc-Graw hill
2. "Applied numerical analysis", Curtis F.Gerald, partick.O.WheatlyAddison-wesley,1989
3."Numerical methods", Douglas J. Faires, Riched Burden Brooks/cole publishing company, 1998.Second edition.

Reference Books

1."Numerical mathematics and computing", Ward cheney &David Kincaid Brooks/Cole publishing company1999,fourth edition.
2. "Mathematical methods for physics and engineering"Riley K.F.M.P.Hobson.&. Bence S.J.Cambridge university press,1999.

Online Learning Resources

1.https://www.coursera.org/lecture/datascimed/computational-methods-86iP7

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	1	1
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	1	1

I Year M.Tech. MD – I Semester

Code: B11502	**ADVANCED FINITE ELEMENT METHODS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives

• You learn modern analysis techniques used widely in engineeringpractice and the sciences, and you use these techniques in a general finite element program.

• You learn how to establish computational models of problems of solids and fluids, solvethem on your laptop, and assess the accuracy of the results.

• You capitalize on your knowledge of mechanics, reinforce your knowledge, and solve problems that can only be tackled numerically on the computer. Great knowledge in yourtool box whatever your goals

Course Outcomes

• Students will learn the mathematical formulation of the finite element method and how to apply it to basic (linear) ordinary and partial differential equations.

• Solve 1- D problems. & 2- D Structural & Heat Transfer Problems using FEA

• Solve Trusses & Beams Problems using FEA

• Formulate & solve structural & dynamics problems

UNIT - I

One-dimensional finite element methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin,

UNIT - III

Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects. Beams and Frames: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT - IV

Two dimensional problems: CST, LST, four noded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin. Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration.

UNIT - V

Finite elements in Structural Dynamics: Dynamic equations, eigen value problems, and their solution methods, simple problems. Convergence: Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, pascal's triangle.

Textbooks:

1. Introduction to Finite element methods by Chandraputla & Ashok D.Belagondu by Pearson 2012

2. Concepts and Applications of Finite Element Analysis By Robert D. Cook, David S. Malkus,

Michael E. Plesha, Robert J. Witt

Reference Books

1. Finite element method in Heat transfer and fluid dynamics, J.N.Reddy, CRC press,1994
2. Finite Element Method, Zienckiwicz O.C. & R. L. Taylor,McGraw-Hill,1983.
3. Finite Element of Nonlinear continua, . J. N. Oden, McGraw-Hill, New York, 1971.
4. Finite element procedures, K. J. Bathe, Prentice-Hall, 1996.

Online Learning Resources

https://nptel.ac.in/courses/112/104/112104193/

https://nptel.ac.in/courses/112/104/112104205/

https://nptel.ac.in/courses/105/105/105105041/

https://nptel.ac.in/courses/112/106/112106130/

https://nptel.ac.in/courses/112/103/112103295/

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	1	1
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	1	1
CO4					-	-	-	-	-	-	-	-			

I Year M.Tech. MD – I Semester

Code: B11503	**ADVANCED MECHANISMS**	**L**	**T**	**P**	**C**
	Program Elective Course – I	**3**	**0**	**0**	**3**

Course Objectives:

- To develop student understanding of the theoretical background for basic and advancedkinematics and synthesis of mechanisms to achieve desired motion.
- To introduce students to basic and advanced computer-based tools for analysis and mechanisms.
- To provide an opportunity for students to use theory and application tools through a majormechanism design project.
- To improve student ability to communicate understanding of the subject through professionaltechnical reports and oral presentations.

Course Outcomes (CO): Student will be able to

- Will study advanced topics in kinematics with a focus of mechanism synthesis techniques.
- Focus on planar mechanism, but will also treat spherical and spatial mechanisms.
- Come from a variety of sources including class notes, texts, and journal articles.
- Study include: review of kinematics fundamentals, classification of mechanisms, type synthesis, graphical synthesis techniques, and analytical synthesis techniques including dyad form, ground pivot specification, M&K circles, Burmester curves, Che by chev spacing, velocity synthesis, four and five prescribed positions, and multi-loop synthesis. Spherical mechanisms, spatial mechanisms, spatial transformations, and spatial dyad synthesis will also be discussed.
- Involve large amounts of team interaction through active learning activities in class and a major design project, which will implement the key topics presented in class through practical applications.

UNIT – I

Introduction: Elements of Mechanisms; Mobility Criterion for Planar mechanisms and manipulators; Mobility Criterion for spatial mechanisms and manipulators. Spherical mechanism-spherical trigonometry.

Kinematics of plane motion- I: The Inflection circle ; Euler – Savary Equation; Analytical and graphical determination of dį; Bobillier's Construction; Collineastion axis; Hartmann's Construction; Inflection circle for the relative motion of two moving planes; Application of the Inflection circle to kinematic analysis.

UNIT – II

Kinematics of plane motion - II: Polode curvature; Hall's Equation; Polode curvature in the fourbar mechanism; coupler motion; relative motion of the output and input links; etermination of the output angular acceleration and its Rate of change; Freudenstein's collineation –axis theorem; Carter –Hall circle; The circling – point curve for the Coupler of a four bar mechanism.

UNIT – III

Introduction to Synthesis-Graphical Methods: The Four bar linkage ;Guiding a body through Two distinct positions; Guiding a body through Three distinct positions; The Rotocenter triangle; Guiding

a body through Four distinct positions; Burmester's curve.

Function generation- General discussion; Function generation: Relative –rotocenter method, Overlay's method, Function generation- Velocity – pole method; Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem.

UNIT – IV

Introduction to Synthesis - Analytical Methods: Function Generation: Freudenstien's equation, Precision point approximation, Precision – derivative approximation; Path Generation: Synthesisof Four-bar Mechanisms for specified instantaneous condition; Method of components; Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link; Method of components.

UNIT – V

Manipulator kinematics: D-H notation, D-H convention of assignment of co-ordinate frames and link parameters table; D-H transformation matrix ; Direct and Inverse kinematic analysis of Serial manipulators: Articulated ,spherical & industrial robot manipulators- PUMA, SCARA,STANFORD ARM, MICROBOT. Differential kinematics Formulation of Jacobian for planar serial manipulators and spherical manipulator; Singularity analysis.

Textbooks:

1. Jeremy Hirschhorn, Kinematics and Dynamics of plane mechanisms, McGraw-Hill,1962.
2. L.Sciavicco and B.Siciliano, Modelling and control of Robot manipulators, Second edition,Springer Verlag ,London 2000.

Reference Books:

1. Amitabh Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines. E.W.P. Publishers.

Online Learning Resources:

- https://www.iitg.ac.in/kd/Lecture%20Notes/ME101-Lecture31-KD.pdf
- https://www.youtube.com/watch?v=4LsLy9iJKFA
- http://faculty.mae.carleton.ca/John_Hayes/5507Notes/Ch1JH.pdf
- https://www.youtube.com/watch?v=r8noZ11OZSY
- https://www.youtube.com/watch?v=X7iBT5l599c
- http://www.ene.ttu.ee/elektriajamid/oppeinfo/materjal/AAR0040/02_Robotics.pdf
- https://faraday.emu.edu.tr/eeng428/lecture_notes.htm

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	1	1
CO3	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	1	1

I Year M.Tech. MD – I Semester

Code: B11504	**COMPUTER APPLICATIONS IN DESIGN**	**L**	**T**	**P**	**C**
	Program Elective Course – I	**3**	**0**	**0**	**3**

Course Objectives:

- To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

Course Outcomes (CO): Student will be able to

- With laboratory classes in conjunction, It helps the students to get familiarized with the computer graphics application in design.
- Understanding reinforces the knowledge being learned and shortens the overall learning curves which are necessary to solve CAE problems that arise in engineering.

UNIT – I

INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS

Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotators)windowing - view ports - clipping transformation.

UNIT – II

CURVES AND SURFACES MODELLING

Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations.

Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface- surface manipulations.

UNIT – III

NURBS AND SOLID MODELING

NURBS- Basics- curves , lines, arcs, circle and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations - constructive solid Geometry- comparison of representations - user interface for solid modeling.

UNIT – IV

VISUAL REALISM

Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts usingthese packages.

UNIT – V

ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE

Assembly modeling - interferences of positions and orientation - tolerances analysis - mass property calculations - mechanism simulation. Graphics and computing standards– Open GL Data Exchangestandards – IGES, STEP etc– Communication standards.

Textbooks:

1. William M Neumann and Robert F. Sproul "Principles of Computer Graphics",

McGraw Hill Book Co. Singapore, 1989.

2. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 1992

Geometric Modeling by Michael E. Mortenson

Reference Books:

1. Ibrahim Zeid Mastering CAD/CAM – McGraw Hill, International Edition, 2007.
2. Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education – 2003.
3. David F. Rogers, James Alan Adams "Mathematical elements for computer graphics" second edition, Tata McGraw-Hill edition.

Online Learning Resources:

- https://www.coursehero.com/file/95927477/Computer-applications-in-Design-Full- Notes.pdf/
- https://vssut.ac.in/lecture_notes/lecture1530947994.pdf
- https://www.iare.ac.in/sites/default/files/ACAD%20lecture%20Notes.pdf
- https://en.wikipedia.org/wiki/CAD_data_exchange
- https://www.youtube.com/watch?v=m9U_XmnHQMU
- https://www.youtube.com/watch?v=0h2M-1BuR1E
- https://en.wikipedia.org/wiki/Solid_Modeling_Solutions

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	3	-	-	-	-	-	-	-	-	2	2	1
CO3	3	2	3	3	-	-	-	-	-	-	-	-	2	2	1
CO4	3	3	2	3	-	-	-	-	-	-	-	-	2	2	1

I Year M.Tech. MD – I Semester

Code: B11505	**MATERIALS TECHNOLOGY**	**L**	**T**	**P**	**C**
	Program Elective Course – I	**3**	**0**	**0**	**3**

Course Objectives:

- The student should be able to understand and classify the sub branches and domains of Materials & Metallurgical Engineering stream.
- The student should be able to analyze the possible opportunities in the domains of Materials & Metallurgical Engineering.
- The student should be able to understand all basic principles involved in the theory of Elasticity and Plasticity

Course Outcomes (CO): Student will be able to

- Understand and create the areas and domains in Materials & Metallurgical Engineering on thebasis of his/her interest and opportunity available in present industrial scenario.
- The student will be able to understand the basic principles of selection of materials and challenges to entrepreneurs in metallurgy

UNIT – I

Elasticity in metals and polymers: Mechanism of plastic deformation, role of dislocations, yield stress,shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening.

UNIT – II

Poly phase mixture, precipitation: particle, fiber and dispersion strengthening, effect of temperature,strain and strain rate on plastic behavior, super plasticity, deformation of nanocrystalline material. Motivation of selection, cost basis and service requirements, selection for mechanical properties, strength, toughness, fatigue and creep.

UNIT – III

Modern metallic Materials: Dual phase steels, micro alloyed, high strength low alloy (HSLA)Steel, transformation induced plasticity (TRIP) Steel, maraging steel, intermetallic, Ni and Ti aluminides

UNIT – IV

Smart materials: shape memory alloys, metallic glass, quasi crystal and nano crystalline materials. Non metallic materials: Polymeric materials and their molecular structures, production techniques for fibers, foams, adhesives and coatings, structure, properties and applications of engineering polymers.

UNIT – V

Advanced structural ceramics: WC, TiC, TaC, Al2O3, SiC, Si3 N4, CBN and diamond-properties,processing and applications. Advance structural composites; Introduction, reinforcement, types of composite materials, -properties, processing and application, and mechanics of composite materials.

Textbooks:

1. Mechanical behavior of materials/Thomas H. Courtney/2nd Edition, McGraw-Hill, 2000

Mechanical Metallurgy/George E. Dieter/McGraw Hill, 1998

Reference Books

1. Selection and use of Engineering Materials 3e/Charles J.A/Butterworth Heiremann.

Online Learning Resources:

- https://nptel.ac.in/courses/112/108/112108150/
- https://ocw.mit.edu/courses/materials-science-and-engineering/3-012-fundamentals-of-materials- science- fall-2005/lecture-notes/
- https://www.vssut.ac.in/lecture-notes.php?url=metallurgical-materials-engineering
- .https://www.researchgate.net/publication/305356293_Advanced_metallic_materials_and_processes
- https://www.youtube.com/watch?v=yXHlIowQntk
- .https://nptel.ac.in/courses/112/104/112104251
- .https://www.youtube.com/watch?v=b5IPJeCDEPw
- https://nptel.ac.in/courses/112/108/112108092/

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	2	1

I Year M.Tech. MD – I Semester

Code: B11506	**ADVANCED MECHANICS OF SOLIDS**	**L**	**T**	**P**	**C**
	Program Elective Course – II	**3**	**0**	**0**	**3**

Course Objectives: Students would be able to

- Describe the concept of "stress at a point" (state of stress and strain in 3D)
- Analyze the transformation of stress and strain in 3D including the utilization of yield criteria
- Apply the knowledge to design the mechanical structures in the view point of both strength and deformation including the design by means of numerical simulation.

Course Outcomes (CO): Student will be able to

- **Fundamental Concept**, Introduction to Cartesian Tensors, Two and Three Dimensional Theories of Stress and Strain (Method of Continuum Mechanics, Theory of Elasticity), Generalized Hooke's Law (Linear Stress-Strain-Temperature), Energy Principal in Solid Continuum, Application of Energy Methods, Inelastic Material Behavior, Theories of Failure, Application of Elasticity

UNIT - I

Shear center: Bending axis and shear center- shear center for axi-symmetric and unsymmetrical sections **Unsymmetrical bending:** Bending stresses in Beams subjected to Non symmetrical bending; Deflection of straight beams due to non symmetrical bending.

UNIT - II

Curved beam theory: Winkler Bach formula for circumferential stress – Limitations – Correction factors –Radial stress in curved beams – closed ring subjected to concentrated and uniform loads stresses in chain links.

Torsion : Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section ;Hollow thin wall torsion members ,Multiply connected Cross Section.

UNIT - III

Contact stresses: Introduction; problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

UNIT - IV

Two Dimensional Elasticity Problems: Plane stress & Plain strain-Problems in Rectangular Coordinates, bending of cantilever loaded at the end, bending of a beam by uniform load. General equations in polar coordinates, stress distribution symmetrical about an axis, pure bending of curved bars, displacements for symmetrical stress distributions, rotating discs.

UNIT - V

Introduction to Three Dimensional Problems: Uniform stress stretching of a prismatical bar by its own weight, twist of circular shafts of constant cross section, pure bending of plates.

Textbooks:

1. Advanced Mechanics of materials by Boresi & Sidebottom-Wiely International.

2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw-Hill Publishers 3/e

Reference Books:

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates – Timoshenko.
3. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia
4. Strength of materials by Sadhu singh

Online Learning Resources:

- http://www.facweb.iitkgp.ac.in/~jeevanjyoti/teaching/advmechsolids/2019/
- https://nptel.ac.in/courses/112/101/112101095/
- https://www.youtube.com/watch?v=4meZNc2wB4s
- https://www.youtube.com/watch?v=89bKgHmRQbw
- https://slideplayer.com/slide/5016902/

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	1	1
CO2	3	2	3	2	-	-	-	-	-	-	-	-	3	1	1
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1

I Year M.Tech. MD – I Semester

Code: B11507	**TRIBOLOGY IN DESIGN**	**L**	**T**	**P**	**C**
	Program Elective Course – II	**3**	**0**	**0**	**3**

Course Objectives:

- Majority of mechanical equipment / mechanisms involve relative motion of links or parts.
- The course intends to impart concepts of friction, wear and lubrication and application of tribology in design of mechanical components is also introduce

Course Outcomes (CO): Student will be able to

- Understand the fundamentals of tribology and associated parameters.
- Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.

UNIT – I

Introduction: Nature of surfaces and contact-Surface topography-friction and wear mechanisms and effect of lubricants- methods of fluid film formation. Selection of rolling element bearings: Nominal life, static and dynamic capacity-Equivalent load, probabilities of survival- cubic mean load- bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

UNIT – II

Hydrodynamic bearings: Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number- performance parameters – optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiple pad bearings-optimum condition with largest minimum film thickness.

UNIT – III

Hydrostatic Bearings: Thrust bearings – pad coefficients- restriction- optimum film thickness journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings – design procedure. Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approach only.

UNIT – IV

Lubrication: Choice of lubricants, types of oil, Grease and solid lubricants- additives- lubrication systems and their selection – selection of pump, filters, piping design- oil changing and oil conservation.

UNIT – V

Seals: different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection of mechanical seals. Failure of Tribological components: Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using soap and Ferrography.

Textbooks:

1. Rowe WW& O' Dionoghue,"Hydrostatic and Hybrid bearing design " Butterworths & Co.Publishers Ltd,1983.
2. Collacott R.A," Mechanical Fault diagnosis and condition monitoring", Chapman and Hall, London 1977.
3. Bernard J.Hamrock, " Fundamentals of fluid film lubricant", Mc Graw-Hill Co.,1994

Reference Books:

1. Neale MJ, (Editor) "Tribology hand Book" Neumann Butter worths, 1975.
2. Connor and Boyd JJO (Editors) " Standard hand book of lubrication engineers " ASLE, Mc Graw Hill Book & Co.,1968
3. Shigley J, E Charles," Mechanical Engineering Design", McGraw Hill Co., 1989

Online Learning Resources:

- https://nptel.ac.in/courses/112/102/112102015/
- https://nptel.ac.in/courses/112/102/112102014/
- https://ocw.mit.edu/courses/mechanical-engineering/2-800-tribology-fall-2004/lecture-notes/
- https://www.notes4free.in/admin/postimages/Tribology-Notes_compressed_watermark.pdf
- https://www.youtube.com/watch?v=SBFSb_Qy6PI
- https://nptel.ac.in/courses/113/108/113108083/
- https://youtu.be/mI8AHUwmrDo

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	2	3	2	-	-	-	-	-	-	-	-	2	1	1
CO3	3	2	3	2	-	-	-	-	-	-	-	-	3	1	1
CO4	2	3	3	2	-	-	-	-	-	-	-	-	3	1	1

I Year M.Tech. MD – I Semester

Code: B11508	**GEAR ENGINEERING**	**L**	**T**	**P**	**C**
	Program Elective Course – II	**3**	**0**	**0**	**3**

Course Objectives:

- This course introduces all varieties of Circuit Breakers and Relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards.
- It emphasis on Neutral grounding for overall protection.

Course Outcomes (CO): Student will be able to

- Study of different gear are necessary to have an idea while designing the spur gear, helical gear, worm gear and Optimal Gear design

UNIT – I

Introduction: Principles of gear tooth action, Generation of Cycloid and Involute gears, Involutometry, gear manufacturing processes and inspection, gear tooth failure modes, stresses, selection of right kind of gears. Spur Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of spur gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT – II

Helical Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of helical gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT – III

Bevel Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of bevel gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT – IV

Worm Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of worm gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Heat dissipation considerations.

Design of gear shaft and bearings. Gear failures Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth breakage, pitting, scoring, wear, over loading, gear- casing problems, lubrication failures

UNIT – V

Gear trains: Simple, compound and epicyclic gear trains, Ray diagrams, Design of a gear box of an automobile, Design of gear trains from the propeller shafts of airplanes for auxiliary systems. **Optimal Gear** design: Optimization of gear design parameters, Weight minimization, Constraints in gear train design-space, interference, strength, dynamic considerations, rigidity etc. Compact design of gear trains, multi objective optimization of gear trains. Application of Traditional and non-traditional optimization techniques

Textbooks:

1. Maleev and Hartman, Machine Design, C.B.S. Publishers, India.
2. Henry E.Merrit,Gear engineering ,Wheeler publishing,Allahabad,1992.

3. Practical Gear design by Darle W. Dudley, McGraw-Hill book company

Reference Books:

1. Machine Design by Robert L. Norton
2. Earle Buckingham, Analytical mechanics of gears, Dover publications, New York, 1949.
3. G.M. Maitha, Hand book of gear design, Tata Mc. Graw Hill publishing company Ltd.,New Delhi,1994.

Online Learning Resources:

- https://nptel.ac.in/courses/112/105/112105234/
- https://youtu.be/AS0zQhMfJUw
- https://youtu.be/i9xbJTIGJlE
- https://youtu.be/sTvWp0L8RtI
- ttps://nptel.ac.in/courses/112/105/112105219/
- https://nptel.ac.in/courses/112/106/112106179/
- https://www.youtube.com/watch?v=maa0LhRK9d4

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	2	3	2	-	-	-	-	-	-	-	-	2	1	1
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	1	1
CO4	2	3	3	2	-	-	-	-	-	-	-	-	3	1	1

Year M.Tech. MD–I Semester

Code: B11509	**NUMERICAL SIMULATION LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives

Students able to understand the software analysis

Course Outcomes

- Apply built-in functions in MATLAB/ SCILAB to solve numerical problems.
- Develop code for solving problems involving different types of mathematical models and equations (ODE, PDE, Linear and nonlinear equations).
- Solve simulation problems encountered in mechanical design, vibration analysis and CAD
- Model a system and Develop a simulation code towards a mini project

List of Experiments:

1. Introduction to MATLAB / SCILAB and practice
2. Practice session on handling basic arithmetic elements.
3. Writing codes with control loops, functions and scripts
4. Developing codes for visualization and plotting
5. Solving problems involving linear and nonlinear equations
6. Solving problems involving curve fitting and interpolations
7. Solving problems involving ordinary and partial differential equations
8. Solving problems related to optimization
9. Solving problems involving numerical differentiation and integrations
10. Introduction to Simulink
11. Case studies and working on projects – I
12. Case studies and working on projects - II

References:

1. Introduction to MATLAB & SIMULINK for Engineers by Agam Kumar Tyagi

Online learning resources/Virtual labs:

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO2	3	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	3	1

I Year M.Tech.MD–I Semester

Code: B11510	**ADVANCED COMPUTER AIDED DESIGN LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives

Students should be able to understand about MATLAB/ SCILAB

Students should be able to understand different mathematical models

Students should be able to understand vibration analysis and CAD

Course Outcomes

- Apply built-in functions in MATLAB/ SCILAB to solve numerical problems.
- Develop code for solving problems involving different types of mathematical models and equations (ODE, PDE, Linear and nonlinear equations).
- Solve simulation problems encountered in mechanical design, vibration analysis and CAD
- Model a system and Develop a simulation code towards a mini project

List of Experiments

1. Introduction to MATLAB and practice
2. Practice session on handling basic arithmetic etc.
3. Writing codes with control loops, functions and scripts
4. Developing codes for visualization and plotting
5. Solving problems involving linear and nonlinear equations
6. Solving problems involving curve fitting and interpolations
7. Solving problems involving ordinary and partial differential equations
8. Solving problems related to optimization
9. Solving problems involving numerical differentiation and integrations
10. Introduction to Simulink
11. Case studies and working on projects
12. Case studies and working on projects

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO2	2	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO3	1	2	1	2	-	-	-	-	-	-	-	-	2	3	1
CO4	1	1	2	2	-	-	-	-	-	-	-	-	2	3	1

I Year M.Tech.MD–I Semester

Code: B1MC01	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**	**C**
		0	**0**	**0**	**2**

Course Objectives

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues understand the Preparation of a research project thesis report.
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copyrights.
- Understand the Adequate knowledge on IPR

Course Outcomes

- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- 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.
- 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

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

UNIT - II

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

UNIT - III

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 PCT.

UNIT - IV

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

UNIT - V

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.

Textbooks

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

Reference Books

1. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.

3. Mayall, “Industrial Design”, McGraw Hill, 1992.

4. Niebel, “Product Design”, McGraw Hill, 1974.

5. Asimov, “Introduction to Design”, Prentice Hall, 1962.

6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

I Year M.Tech.MD–I Semester

Code: B1AC01	**ENGLISH FOR RESEARCH PAPER WRITING**	**L**	**T**	**P**	**C**
	Audit Course-1	**2**	**0**	**0**	**0**

Course Objectives: This course will enable students

- Understand the essentials of writing skills and their level of readability.
- Learn about what to write in each section.
- Ensure qualitative presentation with linguistic accuracy.

Course Outcomes (CO): Students will be able to

- Understand the significance of writing skills and the level of readability
- Analyze and write title, abstract, different sections in research paper
- Develop the skills needed while writing a research paper

UNIT-1

Overview of a Research Paper - Planning and Preparation - Word Order - Useful Phrases - Breaking up Long Sentences – Structuring Paragraphs and Sentences – Being Concise and Removing Redundancy – Avoiding Ambiguity

UNIT-2

Essential Components of a Research Paper - Abstracts – Building Hypothesis – Research Problem - Highlight Findings - Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization

UNIT-3

Introducing Review of the Literature – Methodology - Analysis of the Data – Findings - Discussion - Conclusions - Recommendations.

UNIT-4

Key skills needed for writing a Title, Abstract, and Introduction

UNIT-5

Appropriate language to formulate Methodology, incorporate Results, put forth Arguments and draw Conclusions

Suggested Reading

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses [Volume-I]
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
4. Adrian Wall work, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

I Year M.Tech.MD–I Semester

Code: B1AC02	**DISASTER MANAGEMENT**	**L**	**T**	**P**	**C**
	Audit Course-1	**2**	**0**	**0**	**0**

Course Objectives: This course will enable students

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

Course Outcomes (CO):

- Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle.
- The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.
- Capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

UNIT-1

Introduction:

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

Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches,

Man-made disaster: Nuclear Reactor Melt down, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-3

Disaster Preparedness and Management:

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-4

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

UNIT-5

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non – Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Reading

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

I Year M.Tech.MD–I Semester

Code: B1AC03	**SANSKRIT FOR TECHNICAL KNOWLEDGE**	**L**	**T**	**P**	**C**
	Audit Course-1	**2**	**0**	**0**	**0**

Course Objectives: This course will enable students

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

Course Outcomes (CO): Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-1

Alphabets in Sanskrit

UNIT-2

Past/Present/Future Tense, Simple Sentences

UNIT-3

Order, Introduction of roots

UNIT-4

Technical information about Sanskrit Literature

UNIT-5

Technical concepts of Engineering - Electrical, Mechanical, Architecture, Mathematics

Suggested Reading

1. "Abhyaspustakam" – Dr. Vishwas, Sanskrit – Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha – Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition "Suresh Soni, Oceanbooks(P)Ltd., New Delhi

I Year M.Tech.MD–II Semester

Code: B11511	**ADVANCED OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Many real –world problems require advance techniques to formulate and to solve, and sometimes new optimization algorithms and procedures need to be designed.
- The objective of this class is to help students become optimizers, who have solid understanding of basic theory and also practical skills to model and solve real-world problems.
- Students will learn a deeper understanding of the key concepts, theory, and algorithms of linear optimization, integer optimization, and some modern convex optimization, more advanced modeling techniques, ways of solving optimization problems that are too hard, too large for direction solution, ways of solving optimization problems faster when speed is essential, ways to assess the quality of sub-optimal solutions.

Course Objectives: Student will be able to

- Understand the basic theory and some advanced topics in linear optimization, integer optimization, and convex optimization.
- Identify the proper optimization technique(s) to attempt when problems are too large or too complicated to solve in a straightforward way.
- Use optimization software and implement solution algorithms involving large scale optimization techniques. Handle large data sets that accompany real-world optimization problems.

UNIT – I

Integer programming- cutting plane method and branch and bound technique, mixed integer programming

UNIT – II

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method

UNIT – III

Genetic algorithm (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, solving differential equations using GP.

UNIT – IV

Multi-Objective Decision making: Introduction to goal programming, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi objective problems. Introduction to Analytical hierarchical process, analytical network process.

UNIT – V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Textbooks:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S. Rao, New Age Publishers

Reference Books:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E. Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publisher

Online Learning Resources:

1. https://www.youtube.com/watch?v=eo2tOPV3AoE
2. https://www.youtube.com/watch?v=4t3z8y4CAcs
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/lecture-videos/lecture-1-introduction-and-optimization-problems
4. https://ocw.mit.edu/courses/sloan-school-of-management/15-093j-optimization-methods-fall2009/lecture-notes
5. https://web.eng.fiu.edu/arleon/courses/Optimization/Lectures/Classical_Optimization.pdf
6. https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L4_LN.pdf
7. https://www.iare.ac.in/sites/default/files/OT%20Complete%20Notes_1.pdf

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	2	1

I Year M.Tech. MD–II Semester

Code: B11512	**FRACTURE, FATIGUE & CREEP DEFORMATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Provide an understanding of the mechanics and micro-mechanisms of elastic and plastic deformation, creep, fracture, and fatigue failure, as applied to metals, ceramics, composites, thin film and biological materials.
- Provide a thorough introduction to the principles of fracture mechanics.
- Provide practical examples of the application of fracture mechanics to design and life prediction methods and reporting.
- Provide a basis for the use of fractography as a diagnostic tool for structural failures

Course Outcomes (CO): Student will be able to

- Ability to use simple continuum mechanics and elasticity to determine the stresses, strains, and displacements in a loaded structure.
- Understanding and mathematical modeling of the elements of plastic deformation, with respect to continuum and microscopic mechanisms.
- Ability to use creep data to predict the life of structures at elevated temperatures and the understanding of mechanisms of creep deformation and fracture.
- Use of fracture mechanics to quantitatively estimate failure criteria for both elastically and plastically deforming structures, in the design of life prediction strategies, and for fracture control plans, with examples from automotive, aerospace, medical, and other industries
- Understanding of fatigue and how this affects structural lifetimes of components. Design of metals, ceramics, composites, and biological materials for optimal failure and fatigue analysis.

UNIT – I:

Introduction: Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behavior. Fracture in brittle and ductile materials – characteristics of fracture surfaces; intergranular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, The ductile/brittle fracture transition temperature for notched and unnotched components. Fracture at elevated temperature.

Griffiths analysis: Concept of energy release rate, G, and fracture energy, R. Modification for ductile materials, loading conditions. Concept of R curves.

UNIT – II:

Linear Elastic Fracture Mechanics, (LEFM). Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor.

The effect of Constraint, definition of plane stress and plane strain and the effect of component thickness. The plasticity at the crack tip and the principles behind the approximate derivation of plastic zone shape and size. Limits on the applicability of LEFM.

UNIT – III:

Elastic-Plastic Fracture Mechanics; (EPFM). The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

The effect of Microstructure on fracture mechanism and path, cleavage and ductile failure, factors improving toughness

UNIT – IV

Fatigue: definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodman's rule and Miners rule. Micro mechanisms of fatigue damage, fatigue limits and initiation and propagation control, leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

UNIT – V

Creep deformation: the evolution of creep damage, primary, secondary and tertiary creep. Micro mechanisms of creep in materials and the role of diffusion. Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller parameters. Creep-fatigue interactions.

Textbooks:

1. T.L. Anderson, Fracture Mechanics Fundamentals and Applications, 2nd Ed. CRC press, (1995)
2. B. Lawn, Fracture of Brittle Solids, Cambridge Solid State Science Series 2nd ed1993.
3. J.F. Knott, Fundamentals of Fracture Mechanics, Butter worths (1973)
4. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials.
5. H.L.Ewald and R.J.H. Wanhill Fracture Mechanics, Edward Arnold, (1984).

Reference Books:

1. S. Suresh, Fatigue of Materials, Cambridge University Press, (1998)
2. L.B. Freund and S. Suresh, Thin Film Materials Cambridge University Press,(2003).
3. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, (1988)
4. D.C. Stouffer and L.T. Dame, Inelastic Deformation of Metals, Wiley (1996) F.R.N. Nabarro, H.L. deVilliers, The Physics of Creep, Taylor and Francis, (1995)

Online Learning Resources:

- *https://nptel.ac.in/courses/112/107/112107241/*
- *https://youtu.be/FBS9qI0A6mw*

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	1	1
CO2	2	2	3	2	-	-	-	-	-	-	-	-	3	1	1
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	2	2	3	2	-	-	-	-	-	-	-	-	2	1	1

I Year M.Tech.MD–II Semester

Code: B11513	**INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS**	**L**	**T**	**P**	**C**
	Program Elective Course – III	**3**	**0**	**0**	**3**

Course Objectives:

- Create a team name and choose roles for each person on the team. You may use the roles we have in the class or create roles as a team.
- An explanation of roles must be described of your journal. Give an example of a task that role would perform and aquote of what they might say. (Be specific to robotics.)
- A list of who is assigned to each role will be on page 3 of the journal. Remember, your grade will be based on how well you work together. All students have contributed equally.
- We have the ability to use our hands and cognitive skills to work together. This course involves a cognitive understanding of the process of designing a robot.
- This class gives students a real life experience on what it takes to be a professional engineer.

Course Outcomes (CO): Student will be able to

- For each challenge you must design a blue print in your team log.
- This will allow you to see your original design and any changes you make in making sure your robot meet's its objective.
- Remember to label each part and explain how many you need of each part
- Build the robot. You MUST create the blue prints while building the robot
- This will enable you to see if you included everything you need on the blue print
- If you find that as you are building your robot you need more parts, you also need to add those parts to the blue print.

UNIT – I

INTRODUCTION AND ROBOT KINEMATICS

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

UNIT – II

ROBOT DRIVES AND CONTROL

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

UNIT – III

ROBOT SENSORS

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition Training of vision system.

UNIT – IV

ROBOT CELL DESIGN AND APPLICATION

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

UNIT – V

ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Textbooks:

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing,Vision and Intelligence",Mc Graw Hill, 1987.

Reference Books:

1. Yoram Koren," Robotics for Engineers' Mc Graw-Hill, 1987.
2. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering –An
4. Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
5. Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
6. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.
7. Timothy Jordanides et al ,"Expert Systems and Robotics ", Springer –Verlag, New

   York, May 1991.

Online Learning Resources:

1.https://freevideolectures.com/course/4560/nptel-mechanism-robot-kinematics

2.https://see.stanford.edu/course/cs223a

3.https://cosmolearning.org/courses/introduction-to-robotics/video-lectures/

4.https://www.youtube.com/watch?v=0yD3uBshJB0

5.https://nptel.ac.in/courses/112/105/112105236/

6.https://www.youtube.com/watch?v=xrwz9IxpMJg

7.https://www.coursehero.com/file/59785981/Lecture-9-Robot-cell-designppt/

8.https://www.plantautomation-technology.com/articles/different-types-of-robot-programminglanguages

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	2	3	3	-	-	-	-	-	-	-	-	2	1	1

CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1

I Year M.Tech. MD–II Semester

Code: B11514	**EXPERIMENTAL STRESS ANALYSIS**	**L**	**T**	**P**	**C**
	Program Elective Course – III	**3**	**0**	**0**	**3**

Course Objectives:

- To bring awareness on experimental method of finding the response of the structure to different types of load.

Course Outcomes (CO): Student will be able to

- The course covers the basic aspects of experimental stress analysis that includes exhaustive treatment of the most versatile techniques like photo elasticity and strain gauges and also a brief introduction to the emerging techniques like digital image correlation.
- In addition it also provides the fundamental aspects of six different experimental techniques such as Moiré, Brittle Coatings, Holography, Speckle Methods, Thermo elastic Stress Analysis and Caustics.

UNIT - I

Introduction: Theory of Elasticity, Plane stress and plane strain conditions, Compatibility conditions. Three-dimensional stress strain relations. Strain Measurement Methods: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits, effect of poission ratio strain gauge results, measurements of residual strain general applications.

UNIT - II

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures forbrittle coatings analysis, calibration procedures, analysis of brittle coating data.

UNIT - III

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

UNIT - IV

Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics

UNIT - V

Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for Three dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered- light method.

Birefringent Coatings

Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

Textbooks:

1. Experimental stress analysis by Srinath Ls
2. Experimental stress analysis by Dally and Riley,Mc Graw-Hill

Reference Books:

1. A treatise on Mathematical theory of Elasticity by Love .A.H
2. Photo Elasticity by Frocht

Online Learning Resources:

1. *https://nptel.ac.in/courses/112/106/112106247/*
2. *https://youtu.be/wYxl7tt_E7E*
3. *https://nptel.ac.in/courses/112/106/112106068/*
4. *https://youtu.be/sV4VQoenLdI*
5. *https://youtu.be/a0dkrF02N74*
6. *https://www.youtube.com/watch?v=R5gc8-Ycb7Q*

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	1	1

I Year M.Tech. MD–II Semester

Code: B11515	**THEORY OF PLASTICITY**	**L**	**T**	**P**	**C**
	Program Elective Course – III	**3**	**0**	**0**	**3**

Course Objectives:

- Student acquires information on elementary theory of plasticity inclusive the relationship between the external loading and non-linear permanent strainingof hardened metallic isotropic and anisotropic continuum.
- The student will understand the fundamentals of progressive methods of metal forming process design, namely modeling and finite element simulation.

Course Outcomes (CO): Student will be able to

- This is a postgraduate course aimed towards providing strong conceptual foundations for developing continuum theories of plastic deformation.
- In addition we develop several important formulations of plastic flow which are of much practical use in current industrial applications.
- The course begins with a broad overview of plasticity. Next, all the pertinent concepts from continuum mechanics and thermodynamics are introduced. The general theory of plastic flow is then developed using the theory of continuous distribution of dislocations and irreversible thermodynamics.
- Next we discuss the special cases when elasticity is either infinitesimal or absent. The concepts of associative flow rule, hardening, uniqueness, and stability are discussed in detail. We finish the lectures with an introduction to plastic waves.

UNIT - I

Introduction: Modeling Uniaxial behavior in plasticity. Index notation, Cartesian tensors. Yield and failure criteria Stress, stress deviator tensors. Invariants, principal, mean stresses. Elastic strain energy. Mohr's representation of stress in 2 & 3 dimensions. Haigh-Westergaard stress space. Equilibrium equations of a body. Yield criteria: Tresca's, von Mises rules, Drucker-Prager criterion, anisotropic yield criteria.

UNIT - II

Strain at point: Cauchy's formulae for strains, principal strains, principal shear strains, derivative strain tensor. Strain-displacement relationships. Linear elastic stress strain relations, Generalized Hooke's law, nonlinear elastic stress strain relations Principle of virtual work and its rate forms: Drucker's stability postulate, normality, convexityand uniqueness for an elastic solid. Incremental stress strain relations.

UNIT - III

Criteria for loading and unloading: Elastic and plastic strain increment tensors, Plastic potential and flow rule associated with different Yield criteria, Convexity, normality and uniqueness considerations for elastic–plastic materials. Expansion of a thick walled cylinder. Incremental stress strain relationships: Prandtl - Reuss material model. J2 deformation theory, Drucker - Prager material,

General Isotropic materials.

UNIT - IV

Deformation theory of plasticity: Loading surface, Hardening rules. Flow rule and Druckers stability postulate. Concept of effective stress and effective strain, mixed hardening material. Problems. Finite element formulation for an elastic plastic matrix: Numerical algorithms for solving non linear equations, Convergence criteria, Numerical implementations of the elastic plastic incremental constitutive relations.

Bounding surface theory: Uniaxial and multiaxial loading anisotropic material behaviour Theroms of limit analysis : Statically admissible stress field and kinematically admissible velocity field. Upper and lower bound theorms, examples and problems.

Textbooks:

1. Plasticity for structural engineering W.F.Chen s and D.J.Han, Springer verlag-1987. 2. Mechanics of Materials –II, Victor E. Saouma

Reference Books:

1. Theory of elasticity and plasticity by Sadhu Singh
2. Theory of elasticity and plasticity by Timoshenko

Online Learning Resources:

- *https://mae.ufl.edu/nkim/egm6352/Chap4.pdf*
- *https://ocw.mit.edu/resources/res-2-002-finite-element-procedures-for-solids-and-structures-spring2010/nonlinear/lecture-17/*
- *https://www.youtube.com/watch?v=1ydR6LFFbhA*
- *https://www.youtube.com/watch?v=nKVFDQpTCrs*

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	2	1

I Year M.Tech.MD–II Semester

Code: B11516	**MECHANICAL VIBRATIONS**	**L**	**T**	**P**	**C**
	Program Elective Course – IV	**3**	**0**	**0**	**3**

Course Objectives:

- Upon successful completion of this course, you will be able to understand basic and intermediate concepts necessary for the analysis of the dynamics of complex structures under various loading conditions.
- In particular, you will be able to: Syllabus ME 56300 – Mechanical Vibrations: Explain and correlate the structural properties of complex structures to the overall vibration characteristics in order to design systems having required dynamical properties.
- Apply theoretical and numerical procedures to predict the dynamic response of discrete or continuous structural systems under the most diverse loading conditions.
- Develop reduced order models to treat systems with a large number of DOF. Understand and implement approximate methods for the numerical solution of distributed parameter systems.
- Understand the main features of the dynamics of nonlinear lumped parameters systems.

Course Outcomes (CO): Student will be able to

- The course will cover fundamental concepts on the vibration of mechanical systems including, but not limited to, review of systems with one degree for freedom, Lagrange's equations of motion for multiple degree of freedom systems,
- To introduction to matrix methods, transfer functions for harmonic response, impulse response, and step response, convolution integrals for response to arbitrary inputs, principle frequencies and modes, applications to critical speeds, measuring instruments, isolation, torsional systems, introduction to nonlinear problems.

UNIT - I

Single degree of Freedom systems: Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation ; Vibration isolation and transmissibility .

Response to Non Periodic Excitations: unit Impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

UNIT - II

Vibration measuring instruments : Vibrometers, velocity meters & accelerometers Two degree freedom systems: Principal modes – undamped and damped free and forced vibrations ; undamped vibration absorbers ;

UNIT - III

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

UNIT - IV

Numerical Methods: Rayliegh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

UNIT – V

Continuous systems: Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams- Torsional vibrations of shafts. Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

Textbooks:

1. Elements of Vibration Analysis by Meirovitch.
2. Mechanical Vibrations by G.K. Groover.

Reference Books:

1. Vibrations by W.T. Thomson
2. Mechanical Vibrations – Schaum series.
3. Vibration problems in Engineering by S.P. Timoshenko.
4. Mechanical Viabrations – V.Ram Murthy.

Online Learning Resources:

- *https://nptel.ac.in/courses/112/103/112103112/*
- *https://youtu.be/NqiGVeOn9cY*
- *https://youtu.be/KcWCkNdEQfs*
- *https://youtu.be/s287PPKRXBU*
- *https://youtu.be/LaxkM1B3Lm4*
- *https://www.youtube.com/watch?v=bn8Ztp3kTq8*

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	2	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	1	1

I Year M.Tech.MD–II Semester

Code: B11517	**DESIGN FOR MANUFACTURING**	**L**	**T**	**P**	**C**
	Program Elective Course – IV	**3**	**0**	**0**	**3**

Course Objectives:

- Internalize the attributes along which the success or failure of a manufacturing process, machine, or system will be measured: quality, cost, rate and flexibility.
- Provide exposure to arange of current industrial processes and practices used to manufacture products in high and low volumes. Focus in depth on a few selected processes.
- Apply physics to understand the factors that control the rate of production and influence the quality, cost and flexibility of processes.
- Understand the impact of manufacturing constraints on product design and process planning.
- Apply an understanding of variation to the factors that control the production rate and influence the quality, cost and flexibility of processes and systems.

Course Outcomes (CO):

- Manufacturing is how we satisfy human need and create wealth.
- The challenge is to create a product that is responsive to the customer with high quality and low cost.
- A graduate should have the tools and confidence togo into a manufacturing enterprise that is using an unfamiliar process to make a product he/she has not seen, and yet be able to make intelligent decisions.

UNIT – I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT – II

Machining processes: Overview of various machining processes-general design rules for machining- dimensional tolerance and surface roughness-Design for machining–ease–redesigning of Components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT – III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

UNIT – IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design

of brazed joints.

Forging: Design factors for forging–closed die forging design–parting lines of dies–drop forging

Die design– general design recommendations.

UNIT – V

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design Considerations for injection moulding

Textbooks:

1. Design for manufacture, Johncobert, AdissonWesley.1995 Design for manufacture, Johncobert, AdissonWesley.1995
2. Design for Manufacture by Boothroyd,

ReferenceBooks:

1. ASMHandbookVol.20**.**

Online Learning Resources

1. https://nptel.ac.in/courses/112/101/112101005/
2. https://www.iare.ac.in/sites/default/files/lecture_notes/DFMA_LECTURE_NOTES.pdf
3. https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring 2004/lecture-notes/
4. https://dokumen.tips/documents/design-for-manufacturing-and-assembly-1-lecture-notes-on-design- for-manufacturing.html
5. https://www.youtube.com/watch?v=ofmbhbVCUqI
6. https://onlinecourses.nptel.ac.in/noc21_me66/preview

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1

I Year M.Tech. MD–II Semester

Code: B11518	**PRESSURE VESSEL DESIGN**	**L**	**T**	**P**	**C**
	Program Elective Course – IV	**3**	**0**	**0**	**3**

Course Objectives:

- Upon successful completion of this course, you will be able to understand basic and intermediate concepts necessary for the analysis of the dynamics of complex structures under various loading conditions.
- In particular, you will be able to: Syllabus ME 56300 – Mechanical Vibrations: Explain and correlate the structural properties of complex structures to the overall vibration characteristics in order to design systems having required dynamical properties.
- Apply theoretical and numerical procedures to predict the dynamic response of discrete or continuous structural systems under the most diverse loading conditions.
- Develop reduced order models to treat systems with a large number of DOF. Understand and implement approximate methods for the numerical solution of distributed parameter system
- Understand the main features of the dynamics of nonlinear lumped parameters systems

Course Outcomes (CO):

- The course will cover fundamental concepts on the vibration of mechanical systems including, but not limited to, review of systems with one degree for freedom, Lagrange's equations of motion for multiple degree of freedom systems,
- To introduction to matrix methods, transfer functions for harmonic response, impulse response, and step response, convolution integrals for response to arbitrary inputs, principle frequencies and modes, applications to critical speeds, measuring instruments, isolation, torsional systems
- Introduction to nonlinear problems.

UNIT – I

Single degree of Freedom systems: Undamped and damped free vibrations: forced vibrations; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation ; Vibration isolation and transmissibility .

Response to Non Periodic Excitations: unitImpulse, unitstep and unitRampfunctions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace

Transformation method.

UNIT – II

Vibration measuring instruments: Vibrometers, velocity meters &accelerometers.

Two degree freedom systems: Principal modes – un-damped and damped free and forced vibrations, undamped vibration absorbers.

UNIT – III

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis;Methodofmatrixinversion;Torsionalvibrationsofmulti–rotorsystemsandgeared systems; Discrete-Time systems.

UNIT – IV

Numerical Methods: Rayliegh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

UNIT – V

Continuous systems: Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams- Torsional vibrations of shafts.

Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

Textbooks:

1. Elements of Vibration Analysis by Meirovitch.
2. Mechanical Vibrations by G.K.Groover.

ReferenceBooks:

1. Vibrations by W.T.Thomson
2. Mechanical Vibrations–Schaumseries.
3. Vibration problems in Engineering by S.P.Timoshenko.
4. Mechanical Viabrations–V.RamMurthy.

Online Learning Resources

1. https://nptel.ac.in/courses/112/103/112103112/
2. https://youtu.be/NqiGVeOn9cY
3. https://youtu.be/KcWCkNdEQfs
4. https://youtu.be/s287PPKRXBU
5. https://youtu.be/LaxkM1B3Lm4
6. https://www.youtube.com/watch?v=bn8Ztp3kTq8

I Year M.Tech. MD–II Semester

Code: B11519	**MACHINE DYNAMICS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives:

- Students able to understand dynamic analysis

Course Outcomes(CO):

- Estimate the natural frequency of damped and undamped systems.
- Estimate the natural frequency of undamped torsional vibration of rotor
- Perform dynamic balancing of rotating and reciprocating masses.
- Analyse the free and forced vibrations of beam element.
- Determine gyroscopic effect of rotating body.

List of Experiments:

1. Natural frequency of simple pendulum
2. Determine the moment of inertia of a flywheel.
3. Determination of steady state amplitude offorced vibratory system
4. Natural frequency of single rotor system
5. Natural frequency of single rotor with damping
6. Undamped free vibrations of beam
7. Damped free vibrations of beam
8. Forced vibrations of beam.
9. Forced vibration beam with damped.
10. Friction and Wear Apparatus
11. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
12. Motorized Gyroscopic Couple Apparatus.

References:

1. Mechanical Vibrations by M. PGrover
2. Online learning resources: Virtual labs.

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	1	1

I Year M.Tech. MD–II Semester

Code: B11520	**MODELLING AND ANALYSISLAB**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives:

- Students should be able to understand modeling of curves and surfaces
- Students should be able to understand FEM concept of trusses, beams and frames.
- Students should be able to understand modeling software for 2-D and3-D.
- Students should be able to solve structural problems using FEM software.

Course Outcomes(CO):

- Develop programs for modeling the synthetic curves and surfaces.
- Develop finite element code to solve problems involving Trusses, Beams and Frames
- Build 2Dand3D objects using a modeling software
- Solve structural problems using finite element software
- Execute mini project involving both modeling and analysis.

List of Experiments:

- Develop Programs for Transformations in CAD.
- Develop Programs for Synthetic Curves in CAD.
- Introduction to Pro/E and working with features like Extrude & Revolve in sketch mode.
- Model solids with features like Hole, Round, Chamfer and Rib.
- Model solids with features like Pattern,Copy,Rotate,Move and Mirror.
- Assembly modeling in Pro/E, Generating, editing and modifying drawings in Pro/E.
- Solution of Trusses problems using the developed code.
- Solution of Beams and Frames using the developed code.
- Solution of problems involving triangular element using the developed code.
- Solution of problems of Trusses using ANSYS.
- Solution of problems of Beams and Frames using ANSYS.
- Solution of problems involving triangular element etc. using ANSYS.

References:

1.Lab manual : Online learning resources/Virtual labs.

Mapping COs with POs & PSOs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	-	-	-	-	2	3	1

CO2	2	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO3	1	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO4	1	2	2	2	-	-	-	-	-	-	-	-	2	3	1

I Year M.Tech.MD–II Semester

Code: B1AC04	**PEDAGOGY STUDIES**	**L**	**T**	**P**	**C**
	Audit Course – II	**2**	**0**	**0**	**0**

Course Objectives:

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

Course Outcomes (CO)

- Students will be able to understand:
- What pedagogical practices are being used by teachers in formal and informal class rooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education(curriculum and practicum)and the school curriculum and guidance materials best support effective pedagogy?

UNIT - I

Introduction and Methodology: Aims and rationale, Policy back ground, Conceptual frame work and terminology Theories of learning,Curriculum,Teacher education.Conceptual frame work,Research questions. Overview of methodology and Searching.

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

Suggested Reading

1. AckersJ,Hardman F(2001)Class room interaction in Kenyan primary schools,Compare, 31 (2): 245-261.
2. Agrawal M(2004)Curricular reform in schools:The importance of evaluation,Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K(2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, LussierK, PryorJ, Westbrook J (2013)Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?International Journal Educational Development, 33 (3): 272–282.

I Year M.Tech.MD–II Semester

Code: B1AC05	**STRESS MANAGEMENT BY YOGA**	**L**	**T**	**P**	**C**
	Audit Course – II	**2**	**0**	**0**	**0**

Course Objectives:

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

Course Outcomes

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT - I

Definitions of Eight parts of yog. (Ashtanga)

UNIT - II

Yam and Niyam.

UNIT - III

Do`s and Don't sin life.

i)Ahinsa, satya, astheya, bramhacharya and aparigrahaii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT - IV

Asan and Pranayam

UNIT - V

i)Various yog poses and their benefits for mind &body

ii)Regularization of breathing techniques and its effects-Types of pranayam

Suggested Reading

1. Yogic Asanas forGroupTarining-Part-I": Janardan SwamiYogabhyasiMandal, Nagpur
2. "Rajayogaor conquering the Internal Nature" by Swami Vivekananda, Advait Asharama (Publication Department), Kolkata

I Year M.Tech.MD–II Semester

Code: B1AC06	**PERSONALITY DEVELOPMENT THROUGH LIFE**	**L**	**T**	**P**	**C**
	Audit Course – II	**2**	**0**	**0**	**0**

Course Objectives

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

Course Outcomes

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT - I

Neetisatakam- Holistic development of personality, Verses-19,20,21,22(wisdom), Verses-29,31,32(pride &heroism) ,Verses-26,28,63,65(virtue)

UNIT - II

Neetisatakam- Holistic development of personality, Verses-52,53,59(dont's) ,Verses-71,73,75,78(do's)

UNIT - III

Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter2-Verses41,47,48,

Chapter3-Verses13,21,27,35,Chapter6-Verses5,13,17,23,35, Chapter18-Verses45,46,48.

UNIT - IV

Statements of basic knowledge. ShrimadBhagwadGeeta:Chapter2-Verses 56,62,68

Chapter12 -Verses13,14,15,16,17,18, Personality of Rolemodel. Shrimad Bhagwad Geeta:

UNIT - V

Chapter2-Verses 17,Chapter3-Verses36,37,42, Chapter4-Verses18,38,39,

Chapter18– Verses37,38,63

Suggested Reading

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