

SYLLABUS
MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	I/I	3	0	0	3
Subject Name	Advanced Mathematics				
Subject Code	MMEMD20S101				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objectives:

1. Understand and be able to use the language, symbols and notation of mathematics.
2. Develop mathematical curiosity and use inductive and deductive reasoning when solving problems
3. Become confident in using mathematics to analyse and solve problems both in school and in real life situations.
4. Appreciate the international dimension of mathematics and its multicultural and historical perspectives.

Course Outcomes:

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

CO1: Implement solution methods using appropriate technology

CO2: Solve systems of linear equations by use of the matrix,

CO3: Compute limits, derivatives, and definite & indefinite integrals of algebraic, logarithmic and exponential functions.

CO4: Analyze functions and their graphs as informed by limits and derivatives, and Solve applied problems using matrices, differentiation and integration.

Unit	Syllabus	Periods
UNIT-I	Linear Algebra: Linear transformation, vector spaces, hash function, Hermite polynomial, Heavisite's unit function and error function. Elementary concepts of Modular mathematics.	8
UNIT-II	Solution of Partial Differential Equation (PDE) by separation of variable method, numerical solution of PDE (Laplace, Poisson's, Parabolic) using finite difference methods, Elementary properties of FT, DFT, WFT, Wavelet transform, Haar transform.	9
UNIT-III	Probability, compound probability and discrete random variable, Binomial, Normal and Poisson's distributions, Sampling distribution, elementary concept of estimation and theory of hypothesis, recurred relations.	9
UNIT-IV	Stochastic process, Markov process transition probability transition probability matrix, just and higher order Markov process, Application of Eigen value problems in Markov Process, Markov chain. Queuing system, transient and steady state, traffic intensity, distribution queuing system, concepts of queuing models (M/M/1: Infinity/ Infinity/ FC FS), (M/M/1: N/ Infinity/ FC FS), (M/M/S: Infinity/ Infinity/ FC FS)	10
UNIT-V	FEM: Variational functionals, Euler Lagrange's equation, Variational forms, Ritz method, Galerkin's method, discretization, finite elements method for one dimensional problems.	9

Text Books:

1. Numerical Mathematical Analysis By James B. Scarborough.
2. Fourier Transforms by J. N. Sheddon.
3. Advance Mathematics for Engr and Sc, Spiegel, Schaum Series, TMH.

Reference Books:

1. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
2. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.
3. Applied Numerical Methods with MATLAB by Steven C Chapra, TMH.
4. Introductory Methods of Numerical Analysis by S.S. Shastry.
5. Introduction of Numerical Analysis by Forberg.
6. Numerical Solution of Differential Equation by M. K. Jain.

SYLLABUS
MACHINE DESIGN

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Theory of Elasticity & Plasticity				
Subject Code		MMEMD20S102				
Paper	English					
	Hindi					
Max. Marks		100				

Course Objectives:

This course is concerned with the development of analytical methods for solving problems in mechanics of materials that are generally considered beyond the scope of basic course in the discipline.

Course Outcomes:

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

CO1: After completing this course, the student should be able to determine the point of location of applied load to avoid twisting in thin sections used in.

CO2: Aerospace applications. Understand the concept of distinguish between neutral and centroidal axes in curved beams.

CO3: Understanding the analogy models developed for analyzing the non-circular bars subjected to torsion, and also analyzing the stresses developed between rolling bodies and stress in three dimensional bodies.

Unit	Syllabus	Periods
UNIT-I	UNSYMMETRICAL BENDING: Product of inertia, transfer equation, transformation of coordinate axis, principal moment of inertia, bending stresses due to unsymmetrical bending of beams of symmetrical and unsymmetrical sections, location of neutral axis, deflection of beams subject to unsymmetrical bending.	8

UNIT-II	SHEAR CENTRE: Location of shear centre for the symmetrical sections such as channel, round and I sections. Shear centre for unsymmetrical sections such as unequal angle, Z and channel sections.	8
UNIT-III	CURVED BEAMS: Bending stresses in beams having initial curvature, location of neutral axis in beams having rectangular, circular, triangular, trapezoidal, I and T sections, variations of bending moment, normal and shear forces in curved beams, crane hooks and chain links, thin rings.	9
UNIT-IV	ELEMENTS OF THEORY OF ELASTICITY: Stress components, strain components, equilibrium equations, Generalized Hooks Law, compatibility equations, and stress function equations in Cartesian and Polar coordinate. Plans stress and plane strain problems: saint Venant's principal use of polynomials. Applications to various cases such as pure bending of narrow beams, bending of prismatic bars, thick cylinders. rotating discs, rotating discs of variable thickness, rotating cylinders. Stress concentration due to a small hole in strained plate.	10
UNIT-V	ELEMENTS OF THEORY OF PLASTICITY: Basic laws of plastic now, criterion or yield under complex stress, the Von Mise's yield criterion, the Tresca and Coulomb yield criteria. Rule for plastic now, condition of plane strain, basic equations for plane strain plasticity, Mohr's circle and physical plane.	9

Text Books:

1. Mechanics Of Material by K. Kumar And Ghai.
2. Strength Of Material by Sadhu Singh.

Reference Books:

1. Theory Of Plasticity by Sadhu Singh.
2. Strength Of Materials (Part - Ii) by V.C. Jindal..

SYLLABUS
MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	I/I	3	0	0	3
Subject Name	Material Science				
Subject Code	MMEMD20S103				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objectives:

1. The main objectives are to provide students with basic understanding of phase transformation by heat treating and stress-induced hardening, linear and nonlinear elastic behaviour.
2. Understanding of deformation under multi axial loading, plastic deformation and yield criteria, dislocation plasticity and strengthening mechanisms, creep, stress concentration effects, brittle versus ductile fracture, fracture mechanisms at different scales, fatigue, contact deformation, and wear.

Course Outcomes:

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

CO1: After completing this course, the student should be able to understand the different modes of failures like fracture, fatigue and creep of ductile and brittle materials.

CO2: Understanding the properties of different types of polymers and composites

CO3: Designing and processing new types of polymers and composites.

Unit	Syllabus	Periods
UNIT-I	Crystal Structure of Metals: General review of crystal structure of metals, Molecular structure, crystallographic notation of atomic planes, imperfections in crystals, surface imperfections.	8
UNIT-II	Electronic Theory of Metals: Electron and Bonding. Bonds in crystals and their effect on the properties of metals, Electron structure of atoms, conductors and insulators and semi-conductors.	9

UNIT-III	Deformation of Metals: Dislocation and slip phenomenon, work-hardening and recrystallization, elastic deformation of metals, atomic basis of elastic behaviour. Plastic deformation of Metals, grain boundary, strain hardening. strain aging strain rate.	10
UNIT-IV	Elasticity: Thermo-elastic effect, relaxation time, measurement of damping capacity, creep phenomenon, hot and cold working of metals, theories of fracture, fatigue limit and its significance, theory of radiation heat treatment of metals.	9
UNIT-V	Ceramics: Composition, crystal structure, effect of structure on properties. Glass, fabrication of ceramic bodies, reinforced structure. Polymers: Types, response to change in temperature, elasticity.	8

Text Books:

1. The structure and properties of metals- Vol. I, III, IV Wolf Series.
2. Element of materials science by Van Vlack.

Reference Books:

1. Physical Metallurgy Principles by Reed Hill.
2. Engg. Material Science by Cidric W. Richards. ,
3. Material Science by Narula

SYLLABUS
MACHINE DESIGN

Class	M.TECH.		L	T	P	C
Semester/Year	I/I		3	0	0	3
Subject Name	Theory of Vibration					
Subject Code	MMEMD20S104					
Paper	English					
	Hindi					
Max. Marks	100					

Course Objectives:

1. To understand the fundamentals of Vibration Theory.
2. To be able to mathematically model real-world mechanical vibration problems

Course Outcomes:

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

CO1: At the end of the course the students will be able to.

CO2: To study the vibrations in machine elements and how to control them.

CO3: Ability to analyze the mathematical model of linear vibratory system.

CO4: Response Obtain linear mathematical models of real life engineering systems.

CO5: Determine vibratory responses of single and multi degree of freedom systems to harmonic and non- harmonic.

Unit	Syllabus	Periods
UNIT-I	Review of single degree freedom free, damped and forced vibration isolation, Transmissibility.	8
UNIT-II	Two degree freedom System: Free vibrations. Principal modes or vibration various examples such as double pendulum, two rotor system torsional oscillations etc. Undamped forced vibrations with harmonic excitation.	9

	Principle of vibration absorbers, Undamped dynamic vibration absorber, tuning of vibration absorber, Torsional vibration absorber system.	
UNIT-III	Many degrees of freedom systems: Exact analysis. Un-damped free vibrations. Influence numbers and Maxwell's reciprocal theorem, torsional vibrations of multi rotor system, vibrations of geared systems. Continuous systems: Vibrations of strings, longitudinal vibrations of bars, torsional Vibrations of circular shafts.	10
UNIT-IV	Many degree of freedom system Numerical Methods: Rayleigh's method, Dunkerley's method, Stodola's method, Matrix iteration method.	8
UNIT-V	Nonlinear Vibration: Various Examples. Perturbation method, forced vibrations with nonlinear spring forces, Jump phenomenon. Self Excited Vibrations: Elementary idea of stable and unstable oscillations, self excited vibrations caused by dry friction, various examples.	9

Text Books:

1. Mechanical Vibration by Grover G. K.
2. Theory Of Vibrations by Tomson W. T.

Reference Books:

1. Mechanical Vibration Analysis by Srinivasan P. Itch.
2. Elements Of Vibration Analysis by Leonard Meirov.

SYLLABUS
MACHINE DESIGN

Class	M.TECH.		L	T	P	C
Semester/Year	I/I		0	0	4	2
Subject Name	ADVANCED DYNAMICS LAB (Lab - I)					
Subject Code	MMEMD20S105					
Paper	English					
	Hindi					
Max. Marks			50			

Course Objectives:

1. To understand the fundamentals of dynamic Theory.
2. To be able to mathematically model real-world mechanical dynamic problems.

Course Outcomes:

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

CO1: At the end of the course the students will be able to.

CO2: To study the dynamics in machine elements and how to control them.

CO3: Ability to analyze the mathematical model of linear dynamic system.

List of Experiments:

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
2. Determination of steady state amplitude of a forced vibratory system.
3. Static balancing using steel balls.
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
5. Field balancing of the thin rotors using vibration pickups.
6. Determination of the magnitude of gyroscopic couple, angular velocity of precession and representation of vectors.
7. Direct Kinematic analysis of a robot.
8. Inverse Kinematic analysis of a robot.
9. Trajectory planning of a robot in joint space scheme.
10. Palletizing operation using Robot programming.
11. To determine the characteristic curves of the Watt and Porter Governors.
12. To determine the characteristic curves of the Proell and Spring-loaded Governors
13. To determine the characteristics of Journal Bearings

Text Books:

1. LAB MANUALS

SYLLABUS
MACHINE DESIGN

Class	M.TECH.		L	T	P	C
Semester/Year	I/I		0	0	4	2
Subject Name	ADVANCED MATERIAL TESTING LAB (Lab - II)					
Subject Code	MMEMD20S106					
Paper	English					
	Hindi					
Max. Marks	50					

Course Objectives:

1. To understand the fundamentals of material Theory.
2. To be able to mathematically model real-world mechanical material problems.

Course Outcomes:

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

CO1: At the end of the course the students will be able to understand the materials.

CO2: To study the material in machine elements and how to control them.

CO3: Ability to analyze the mathematical model of linear material system.

List of Experiments:

1. Preparation and study of the Micro Structure of ferrous metals and alloys.
2. Preparation and study of the Microstructure of nonferrous metals and alloys.
3. Effect of tempering time on the hardness of quenched carbon steels.
4. Effect of tempering temperature on the hardness of a hardened carbon steels.
5. Preparation of metallic specimens by electro polishing.
6. Study of work hardening characteristics of a pure metal.
7. Determination of carbon percentage in the given ferrous specimen.
8. To determine the deflection of a Structural Member using Pin-jointed setup
9. Calculation of Shear Centre of a different cross-sections using Shear Centre setup.
10. To determine the deflection of a Frame using Portal Frame Setup.
11. Analyse the Stress Distribution of a Structural Member using Curved Beam apparatus.
12. Determination of natural frequency of given structure using FFT analyzer.
13. Diagnosis of a machine using FFT analyzer.

Text Books:

1. LAB MANUALS

SYLLABUS
MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	I/I	2	0	0	0
Subject Name	English for Research Paper Writing				
Subject Code	MMEMD20S108				
Paper	English				
	Hindi				
Max. Marks	00				

Course objectives:

Students will be able to:

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

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

CO1: Understand that how to improve your writing skills and level of readability.

CO2: Learn about what to write in each section Understand the skills needed when writing a Title.

CO3: Ensure the good quality of paper at very first-time submission.

CO4: Being Concise and Removing Redundancy, Avoiding Ambiguity.

CO5: Discussion, skills are needed when writing the Conclusions.

Unit	Syllabus	Periods
Unit-I	Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	8
Unit-II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism.	
Unit-III	Sections of a Paper, Abstracts. Introduction. Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.	

Unit-IV	Key skills needed when writing a Title, key skills needed when writing an Abstract, key skills needed when writing an Introduction, skills needed when writing a Review of the Literature, skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills are needed when writing the Conclusions,	
Unit-V	Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.	
<p>Text books:</p> <ol style="list-style-type: none"> 1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books). 2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press. 		
<p>References books:</p> <ol style="list-style-type: none"> 1. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book publication. 2. Adrian Wall work, English for Writing Research Papers, Dordrecht Heidelberg London, 2011. 		

SYLLABUS
MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	I/I	2	0	0	2
Subject Name	Research Methodology and IPR				
Subject Code	MMAT20S111				
Paper	English	English			
	Hindi				
Max. Marks	100				

Course objectives:

1. To explain the functions of the literature review in research and writing a review.
2. To explain various research designs and their characteristics. Methods of data collections.

Course Outcomes:

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

CO1: Understand research problem formulation.

CO2: Analyze research related information.

CO3: Follow research ethics.

CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO5: 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.

Unit	Syllabus	Periods
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.	8

UNIT-II	Effective literature studies approaches, analysis plagiarism, and Research ethics.	9
UNIT-III	Effective technical writing, how to write report, Paper. Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	11
UNIT-IV	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.	13
UNIT-V	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	14

Text books:

1. Asimov, "Introduction to Design", Prentice Hall, 1962.
2. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
3. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

References books:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.

SYLLABUS

MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	II/I	3	0	0	3
Subject Name	Adv. Machine Design				
Subject Code	MMEMD20S201				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objectives:

1. The overall objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines.
2. To find radius of curvature of polodes.

Course Outcomes:

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

- CO1:** After completing this course, the student should be able to Understand the kinematic analysis of rolling bodies based on graphical, geometrical.
- CO2:** Analytical methods. Design of mechanisms by using graphically and analytically by involving function generator.
- CO3:** Rigid body guidance and path generation(Coupler curve) methods.

Unit	Syllabus	Periods
UNIT-I	Gears: Synthesis of tooth profile for circular spur gears, noncircular spur gears with constant distance. Generation of logarithmic function, Elliptical gears, equiangular spirals teeth of lion 'circular gears.	8
UNIT-II	Gear trains: Determination of gear train for a given velocity-ratio upto a desired degree of accuracy. Method of conjugate fraction, properties of conjugate fraction, Broct' stableof fraction and its application. Change speed gears. preferred numbers. "three shaft, step change of speed, arrangement of change speed gear box.	9

UNIT-III	Cams: Forces in rigid system, Mathematical models, analytical methods, position error, jump, shock, unbalance, spring, surge and winding. Synthesis of cams: High speed cam design kloomoek and Muffle analytical function of cycloid, harmonic and eightu power polynomial. Analytical cam design.	9
UNIT-IV	Analytical cam design: Disc cam with radial flat faced follower disc cam with radial roller follower disc cam with oscillating roller follower Linkages: Number synthesis, type synthesis dimensional synthesis four bar linkage Freudenstein's Equation.	9
UNIT-V	Power screws: Friction, Types of Power screws, Multiple threads, Comparison of square and trapezoidal threads, Power screw driver, Efficiency of screws, square threads, Trapezoidal Threads, stresses in screws design calculations, design procedure, other types of screws, differential and compounds screws, ball baring screws.	14
Text Books: 1. Mechanism and dynamics of machinery by M. H. Magic and P. W. Oevirk.		
Reference Books: 1. Gears study Hand book by dudley. 2. Cams study Rothbart.		

SYLLABUS
MACHINE DESIGN

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		FINITE ELEMENT METHOD				
Subject Code		MMEMD20S202				
Paper	English					
	Hindi					
Max. Marks		100				

Course Objectives:

1. To introduce the basic concepts of the finite element method, the boundary element method.
2. To discuss the advantages and limitations of each method.
3. To demonstrate the capabilities of each method on a variety of problems.

Course Outcomes:

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

- CO1:** After completing this course, the student should be able to understand the background of mathematical equations used for development of modelling.
- CO2:** Software modules to develop the various structural related applications identify mathematical model for solution of common engineering problems.
- CO3:** Solve structural, thermal, fluid flow problems.
- CO4:** Use professional-level finite element software to solve engineering problems in Solid.
- CO5:** Mechanics, fluid mechanics and heat transfer.

Unit	Syllabus	Periods
UNIT-I	INTRODUCTION: Background and application of Finite Element Method, Matrix techniques - solution of large system of algebraic equations, inverse of a matrix, Eigen value problem.	8
UNIT-II	THEORY OF FINITE ELEMENT METHOD: Calculus of variation, variation principles. weighted residual "approach. The concept of In	9

	element, various element shapes, isoperimetric elements. Shape functions. A simple structural problem. The F.E.M. solution procedure, plane stress, plane strain body or structure, Mesh refinement, Interelement compatibility and continuity; convergence criteria. Boundary conditions, Solution of the overall problem, Three dimensional stress analysis using tetrahedral and prismatic elements,	
UNIT-III	TECHNIQUES FOR NON LINEAR ANALYSIS: Non linear analysis. Basic nonlinear solution techniques, computer aspects of nonlinear techniques, problems involving material and geometric nonlinearity	8
UNIT-IV	APPLICATION OF FINITE ELEMENT METHOD: Introduction to the solution of problems ill theory of elasticity, fluid flow, heat conduction etc.	9
UNIT-V	PLATE BENDING: Introduction – Plate behavior – C^1 (Kirchoff) Plate elements – C^0 (Mindlin) Plate elements – Mindlin beam – More devices for C^0 Plate elements – Boundary conditions - Analytical problems Nonlinear finite element of solids: Material Nonlinearities, objective rates, nonlinear elasticity, Plasticity, viscoplasticity, viscoelasticity	8
Text Books: 1. Introduction to finite element Method By : Chandrakant S. Dcsai		
Reference Books: 1.The finite element Method By : Zienkiewicz 2.Introduction to finite element Analysis (Theory and Application) By: H.C.Martin andGrahm Carey		

SYLLABUS
MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	II/I	3	0	0	3
Subject Name	ROBOTICS				
Subject Code	MMEMD20S203				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objectives:

1. To Demonstrate knowledge of different types of actuators used in robotic systems.
2. To analyze the position and velocity kinematics of a robot arm, implement in 2D.
3. To analyze the dynamics of a robot arm, implement in 2D.
4. To analyze sensor signals to implement real-time control algorithms.
5. To Demonstrate knowledge of error propagation in electrical, mechanical and computational systems.
6. To construct, program, and test the operation of a robotic system to perform a specified task

Course Outcomes:

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

CO1: Understand the evolution, classification, structures and drives for robots.

CO2: Teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors.

CO3: Expose the students to build a robot for any type of application.

Unit	Syllabus	Periods
UNIT-I	<u>Introduction:</u> Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system. Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom, Requirements and challenges of	10

	end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.	
UNIT-II	<u>Motion Analysis</u> : Homogeneous transformations as applicable to rotation and translation – problems. Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems	9
UNIT-III	Differential transformation and manipulators, Jacobians–problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.	8
UNIT-IV	Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion straight line motion – Robot programming, languages and software packages.	8
UNIT-V	Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors, potentiometers, resolvers, encoders, Velocity sensors. Robot Application in Manufacturing: Material Transfer, Material handling, loading and unloading- Processing, spot and continuous arc welding & spray painting , Assembly and Inspection	10
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Industrial Robotics / Groover M P /Pearson Edu. 2. Robotics and Control / Mittal R K &Nagrath I J / TMH. 		
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Robotics / Fu K S/ McGraw Hill. 2. An Introduction to Robot Technology, / P. Coiffet and M. Chironze / Kogam Page Ltd. 1983ondon. 3. Robotic Engineering / Richard D. Klafter, Prentice Hall 		

SYLLABUS

MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	II/I	3	0	0	3
Subject Name	Industrial Tribology				
Subject Code	MMEMD20S204				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objectives:

1. To explain the processes of lubrication in all regimes.
2. To explain the friction phenomena.
3. To select a suitable lubricant for a specific application.
4. To select a suitable material combination for tribological contacts.
5. To determine the risk of wear by using simple analyses.
6. To suggest an explanation to the cause of a tribological failure.

Course Outcomes:

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

CO1: Understand the different types of lubrications and relevant theories used in supporting element.

CO2: Understand the failure mechanisms in different types of supporting elements.

Unit	Syllabus	Periods
UNIT-I	Friction and Wear Friction Control and Wear prevention, Boundary Lubrication, Tribological properties of Bearing Materials and Lubricants, Theories of friction and wear, instabilities and stick-slip motion.	8
UNIT-II	Lubrication of Bearings:- Mechanics of Fluid Flow, Reynold's Equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed show sliders, infinitely long and infinitely short (narrow) journal bearings, lightly	9

	loaded infinitely long journal bearing (Petroff's solution).	
UNIT-III	Finite Bearings Hydrostatic, Hydrodynamic and thrust oil bearings, heat in bearings. Hydrostatic squeeze film:-Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings.	10
UNIT-IV	Elasto-hydrodynamic Lubrication:-Pressure-viscosity term in Reynold's Equation, Hertz theory, Ertel-Grubin Equation, lubrication of spheres. Air lubricated bearings:- Tilting pad bearings, hydrostatic, hydrodynamic and thrust bearings with air lubrication.	9
UNIT-V	Tribological aspects of rolling motion:- The mechanics of tyre-road interaction, road grip and rolling resistance, Tribological aspects of wheel on rail contact, Tribological aspects of metal rolling, drawing and extrusion. Tribo characteristics of different materials, Evaluation of friction & wear through experiments under influencing parameters, pV value of materials.	10
Text Books:		
<ol style="list-style-type: none"> 1. Basic Lubrication Theory- A Camaron 2. Integral Approaches to Tribo-testing in Mechanical Engineering – Dr H. Prashad 3. Principles of Lubrication – A Camaron, Longman's Green Co. Ltd. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Theory and Practice for Engineers – D. D. Fuller, John Wiley and sons. 2. Fundamental of Friction and Wear of Metals – ASM 3. The Design of Aerostatic Bearings – J. W. Powell 4. Gas Bearings – Grassam and Powell 5. Theory Hydrodynamic Lubrication Pinkush and Sterrolight 		

SYLLABUS
MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	II/I	0	0	4	2
Subject Name	ADVANCED COMPUTER AIDED MODELLING LAB (Lab – III)				
Subject Code	MMEMD20S205				
Paper	English				
	Hindi				
Max. Marks	50				

Course Objectives:

1. Students should be able to use CATIA and Pro-E and software for modeling, tolerance & GD&T analysis of a product.
2. Students should be able to use CATIA software to model a consumer product and industrial robot.

Course Outcomes:

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

CO1: At the end of the course the students will be able to understand the CATIA.

CO2: To study the material software for modeling, tolerance & GD&T analysis of a product..

CO3: Ability to analyze CATIA software to model a consumer product and industrial robot.

List of Experiments:

1. Generation of various 3D Models through pad, shaft, shell sweep.
2. Feature based and Boolean based modeling surface and Assembly Modeling. Design simple components.
3. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
4. To make an isometric dimensional drawing of a connecting rod.
5. Draw Different type's bolts and nuts with internal and external threading in Acme and Square threading standards. Save the bolts and nut as blocks suitable for insertion.
6. To model and assemble the flange coupling as per the dimensions given and also convert the 3D model into different views
7. To model and assemble the Screw jack as per the dimensions given and also convert the 3D model into different views.
8. To model and assemble the strap joint of Gib& cotter as per the dimensions given and also convert the 3D model in to different view.
9. Various Dimensioning and tolerancing techniques on typical products using CAD software.
10. Simulation of Kinematic Mechanism using MS Adams Package

Text Books:

1.LAB MANUALS

SYLLABUS
MACHINE DESIGN

Class	M.TECH.		L	T	P	C
Semester/Year	II/I		0	0	4	2
Subject Name	ADVANCED COMPUTER AIDED ANALYSIS LAB (Lab – IV)					
Subject Code	MMEMD20S206					
Paper	English					
	Hindi					
Max. Marks	50					

Course Objectives:

1. Students should be able to carry out structural, Harmonic and fracture analysis using FEA software for real time applications.
2. Perform Fracture analysis for simple problem using FEAsoftware.

Course Outcomes:

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

- CO1:** At the end of the course the students will be able to understand the analysis of designing aided by computer.
- CO2:** To study the computer aided analysis in machine elements and how to control them.
- CO3:** Ability to analyze the mathematical model of linear computer aided system .

List of Experiments:

1. Analysis of Framed structures using FEA software.
2. Perform Fracture analysis for simple problem using FEA software.
3. Analysis of laminated composite structures using FEA software.
4. Perform a simple modal analysis for a cantilever beam using FEA software.
5. Perform Harmonic analysis for a given cantilever beam using FEA.
6. Perform a simple transient analysis for different beams.
7. Non Linear Analysis: Find the geometric non linearity behavior for a cantilever beam subjected to a large moment.
8. Buckling analysis: Solve simple buckling problems using Eigen value and nonlinear methods
9. Stress analysis of a rectangular plate with a circular hole.
10. Thermal Analysis of 1D & 2D problem with conduction and convection boundary conditions. (Minimum 4 exercises)
11. Design optimization of unknown parameters for a given beam.
12. Use of contact elements to simulate two given beams when they are in contact with each other.
13. Flow Over a Flat Plate: Solve a classical flat plate 2-D air flow problem
14. Using Coupled Structural/Thermal Analysis: solve a simple structural/thermal problems
15. Sub-structuring: Solve a simple problems using Sub-structuring method in ANSYS.
16. Melting Using Element Death: Using element death procedure model melting of a material.

Text Books:

1. LAB MANUALS

SYLLABUS
MACHINE DESIGN

Class	M.TECH.		L	T	P	C
Semester/Year	II/I		0	0	4	2
Subject Name	Mini Project					
Subject Code	MMEMD20S207					
Paper	English	English				
	Hindi					
Max. Marks	50					

Course Objective:

1. The aim of the mini project is that the student has to understand the structural engineering problems
2. The student should gain a thorough knowledge in the problem, he/she has selected and to analyze complex structural systems.

Course Outcomes: At the end of the Subject, the student will be able to:

- CO1:** Identify structural engineering problems reviewing available literature.
- CO2:** Study different techniques used to analyze complex structural systems.
- CO3:** Work on the solutions given and present solution by using his/her technique applying engineering principles.

Contents

1. Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.
2. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals 'contribution.
3. Continuous assessment of Mini Project at Mid Sem and End-Sem will be monitored by the departmental committee.

SYLLABUS
MACHINE DESIGN

Class	M.TECH.	L	T	P	C
Semester/Year	II/I	2	0	0	0
Subject Name	Stress Management by Yoga				
Subject Code	MMEMD20S208				
Paper	English	English			
	Hindi				
Max. Marks	00				

Course Objectives

1. To achieve overall health of body and mind.
2. To overcome stress.

Course Outcomes: Students will be able to:

- CO1:** Develop healthy mind in a healthy body thus improving social health also.
CO2: Improve efficiency

Syllabus

1. Definitions of Eight parts of yog. (Ashtanga).
2. Yam and Niyam. Do's and Don'ts's in life.
3. Ahinsa, satya, astheya, bramhacharya and aparigraha, Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.
4. Asan and Pranayam.
5. Various yog poses and their benefits for mind & body, Regularization of breathing techniques and its effects-Types of pranayam

Suggested reading:

1. 'Yogic Asanas for Group Training - Part I': Janardan Swami Yoga bhyasi Mandal, Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.