JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

SEMESTER – I

S. No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21DBS101	Computational Methods	PC	3	0	0	3
2.	21D04101	Advance Finite element methods	PC	3	0	0	3
3.	21D15101a 21D15101b 21D15101c	**Program Elective Course - I** Advanced Mechanisms Computer Applications in Design Materials Technology	PE	3	0	0	3
	21D15102a 21D15102b 21D15102c	**Program Elective Course - II** Advanced Mechanics of Solids Tribology in Design Gear Engineering	PE	3	0	0	3
5.	21D15103	Numerical Simulation Laboratory	PC	0	0	4	2
6.	21D15104	Advanced Computer Aided Design Lab	PC	0	0	4	2
7.	21DRM101	Research Methodology and IPR	MC	2	0	0	2
8.	21DAC101a 21DAC101b 21DAC101c	**Audit Course – I** English for Research paper writing Disaster Management Sanskrit for Technical Knowledge	AC	2	0	0	0
Total							**18**

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SEMESTER – II

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21D04201	Advanced Optimization Techniques	PC	3	0	0	3
2.	21D15201	Fracture fatigue and creep deformation	PC	3	0	0	3
3.	21D15202a 21D15202b 21D15202c	**Program Elective Course – III** Industrial Robotics and Expert Systems Experimental Stress Analysis Theory of Plasticity	PE	3	0	0	3
4.	21D15203a 21D15203b 21D15203c	**Program Elective Course – IV** Mechanical Vibrations Design For Manufacturing Pressure Vessel Design	PE	3	0	0	3
5.	21D15204	Machine Dynamics Laboratory	PC	0	0	4	2
6.	21D15205	Modelling and Analysis Lab	PC	0	0	4	2
7.	21D15206	Technical seminar	PR	0	0	4	2
8.	21DAC201a 21DAC201b 21DAC201c	**Audit Course – II** Pedagogy Studies Stress Management for Yoga Personality Development through Life Enlightenment Skills	AC	2	0	0	0
		Total					**18**

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SEMSTER - III

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21D15301a 21D15301b 21D15301c	**Program Elective Course – V** Quality Concepts in Design Design of Hydraulic and Pneumatic Systems Applied Engineering Acoustics	PE	3	0	0	3
2.	21DOE301c 21DOE301g 21DOE301h	**Open Elective** Business Analytics Internet Of Things Mechatronics	OE	3	0	0	3
3.	21D15302	Dissertation Phase – I	PR	0	0	20	10
4.	21D15303	Co-curricular Activities					2
Total							**18**

SEMESTER - IV

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21D15401	Dissertation Phase – II	PR	0	0	32	16
		Total					**16**

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Course Code	COMPUTATIONAL METHODS	L	T	P	C
21DBS101		3	0	0	3
	Semester	I			

Course Objectives:

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

Course Outcomes (CO): Student will be able to

- 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		Lecture Hrs:09

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		Lecture Hrs: 09

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

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

UNIT – III		Lecture Hrs: 09

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		Lecture Hrs: 09

Parabolic partial differential equations: Explicit method – Crank - Nickelson method –Derivative 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		Lecture Hrs: 09

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

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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

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Course Code	ADVANCED FINITE ELEMENT METHODS	L	T	P	C
21D04101		3	0	0	3
	Semester	I			

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 (CO): Student will be able to

- 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 — Lecture Hrs: 09

Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements., Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

UNIT - II — Lecture Hrs: 09

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 — Lecture Hrs: 09

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 — Lecture Hrs: 09

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 — Lecture Hrs: 09

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:

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

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Course Code	ADVANCED MECHANISMS	L	T	P	C
21D15101a	Program Elective Course - I	3	0	0	3
	Semester	I			

Course Objectives:

- To develop student understanding of the theoretical background for basic and advanced kinematics and synthesis of mechanisms to achieve desired motion.
- To introduce students to basic and advanced computer-based tools for analysis and synthesis of mechanisms.
- To provide an opportunity for students to use theory and application tools through a major mechanism design project.
- To improve student ability to communicate understanding of the subject throughprofessional technical 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, Chebychev 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		Lecture Hrs: 09

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

Kinematics of plane motion- I: The Inflection circle ; Euler – Savary Equation; Analytical and graphical determination of dj ; 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		Lecture Hrs: 09

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		Lecture Hrs: 09

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		Lecture Hrs: 09

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Introduction to Synthesis - Analytical Methods: Function Generation: Freudenstien's equation, Precision point approximation, Precision – derivative approximation; Path Generation: Synthesis of 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		Lecture Hrs: 09

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

Reference Books:

1. x

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

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Course Code	COMPUTER APPLICATIONS IN DESIGN	L	T	P	C
21D15101b	Program Elective Course - I	3	0	0	3
Semester		I			

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 CAEproblems that arise in engineering.

UNIT - I		Lecture Hrs:09

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		Lecture Hrs: 09

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- Beziersurface and B-Spline surface-surface manipulations.

UNIT - III		Lecture Hrs: 09

NURBS AND SOLID MODELING

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

UNIT - IV		Lecture Hrs: 09

VISUAL REALISM

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

UNIT - V		Lecture Hrs: 09

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 Exchange standards – IGES, STEP etc– Communication standards.

Textbooks:

1. William M Neumann and Robert F. Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore, 1989.
2. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 1992
3. Geometric Modeling by Michael E. Mortenson

Reference Books:

1. Ibrahim Zeid Mastering CAD/CAM – McGraw Hill, International Edition, 2007.

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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

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Course Code	MATERIALS TECHNOLOGY	L	T	P	C
21D15101c	Program Elective Course - I	3	0	0	3
	Semester	I			

Course Objectives:

- The student should be able to understand and classify the sub branches and domains of Materials & Metallurgical Engineeringstream.
- 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 theoryof Elasticity and Plasticity

Course Outcomes (CO): Student will be able to

- Understand and create the areas and domains in Materials & Metallurgical Engineering on the basis 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		Lecture Hrs:09

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

UNIT - II		Lecture Hrs: 09

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

UNIT - III		Lecture Hrs: 09

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

UNIT - IV		Lecture Hrs: 09

Smart materials: shape memory alloys, metallic glass, quasi crystal and nano crystallinematerials.
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		Lecture Hrs: 09

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
2. 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:

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

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6.https://nptel.ac.in/courses/112/104/112104251/
7.https://www.youtube.com/watch?v=b5IPJeCDEPw
8.https://nptel.ac.in/courses/112/108/112108092/

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Course Code	ADVANCED MECHANICS OF SOLIDS	L	T	P	C
21D15102a	Program Elective Course – II	3	0	0	3
	Semester	I			

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	Lecture Hrs:09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

Two Dimensional Elasticity Problems: Plane stress & Plain strain-Problems in Rectangular Co-ordinates, 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	Lecture Hrs: 09

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

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4. Strength of materials by Sadhu singh
Online Learning Resources:
1.http://www.facweb.iitkgp.ac.in/~jeevanjyoti/teaching/advmechsolids/2019/ 2.https://nptel.ac.in/courses/112/101/112101095/ 3.https://www.youtube.com/watch?v=4meZNc2wB4s 4.https://www.youtube.com/watch?v=89bKgHmRQbw 5.https://slideplayer.com/slide/5016902/

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Course Code	TRIBOLOGY IN DESIGN	L	T	P	C
21D15102b	Program Elective Course – II	3	0	0	3
	Semester	I			

Course Objectives:

- Majority of mechanical equipment / mechanisms involve relativemotion 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

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

UNIT – I	Lecture Hrs: 09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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 – qualitativeapproach only.

UNIT – IV	Lecture Hrs: 09

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	Lecture Hrs: 09

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:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

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

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	GEAR ENGINEERING	L	T	P	C
21D15102c	Program Elective Course – II	3	0	0	3
	Semester	I			

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 Lecture Hrs:09

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 Lecture Hrs: 09

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 Lecture Hrs: 09

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 Lecture Hrs: 09

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 Lecture Hrs: 09

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

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COURSE STRUCTURE & SYLLABI

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
- https://nptel.ac.in/courses/112/105/112105219/
- https://nptel.ac.in/courses/112/106/112106179/
- https://www.youtube.com/watch?v=maa0LhRK9d4

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	NUMERICAL SIMULATION LABORATORY	L	T	P	C
21D15103		0	0	4	2
	Semester	I			

Course Objectives:

- Students able to understand the software analysis

Course Outcomes (CO):

At the end of the lab sessions, the student shall be able to:

- 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:

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	ADVANCED COMPUTER AIDED DESIGN AND ANALYSIS LABORATORY	L	T	P	C
21D15104		0	0	4	2
	Semester	I			

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 (CO):

At the end of the lab sessions, the student shall be able to:

- 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

10Introduction to Simulink

11 Case studies and working on projects

12 Case studies and working on projects

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**	**C**
21DRM101		**2**	**0**	**0**	**2**
	Semester	**I**			

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 (CO): Student will be able to

- 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		Lecture Hrs:

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		Lecture Hrs:

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		Lecture Hrs:

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		Lecture Hrs:

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"

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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.

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	ADVANCED OPTIMIZATION TECHNIQUES	L	T	P	C
21D04201		3	0	0	3
	Semester	II			

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 Outcomes (CO): 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 Lecture Hrs:09

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

UNIT – II Lecture Hrs: 09

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 Lecture Hrs: 09

Genetic algorithm (GA) : Differences and similarities between conventional andevolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrainedoptimization, 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 Lecture Hrs: 09

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

UNIT – V Lecture Hrs: 09

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,

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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 Publishers

Online Learning Resources:

- https://www.youtube.com/watch?v=eo2tOPV3AoE
- https://www.youtube.com/watch?v=4t3z8y4CAcs
- 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/
- https://ocw.mit.edu/courses/sloan-school-of-management/15-093j-optimization-methods-fall-2009/lecture-notes/
- https://web.eng.fiu.edu/arleon/courses/Optimization/Lectures/Classical_Optimization.pdf
- https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L4_LN.pdf
  https://www.iare.ac.in/sites/default/files/OT%20Complete%20Notes_1.pdf

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	FRACTURE, FATIGUE & CREEP DEFORMATION	L	T	P	C
21D15201		3	0	0	3
	Semester	**II**			

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 determinethe stresses, strains, and displacements in a loaded structure.
- Understanding and mathematical modeling of the elements of plastic deformation, withrespect 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 andfatigue analysis.

UNIT – I Lecture Hrs:09

Introduction: Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behaviour. Fracture in brittle and ductile materials – characteristics of fracture surfaces; inter-granular 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 Lecture Hrs: 09

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 Lecture Hrs: 09

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

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

UNIT – IV Lecture Hrs: 09

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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. Goodmans rule and Miners rule. Micromechanisms of fatigue damage, fatigue limits and initiation and propagation control, leadingto a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

UNIT – V		Lecture Hrs: 09

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. Examples.

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
- https://youtu.be/8BlAMTz5GNc
- https://www.youtube.com/watch?v=4qxOT3GBRds
- http://www.infocobuild.com/education/audio-video-courses/mechanical-engineering/EngineeringFractureMechanics-IIT-Madras/lecture-04.html
- https://youtu.be/81ttaX6pmt4

https://youtu.be/JPDxaOCbze0

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS	L	T	P	C
21D15202a	Program Elective Course – III	3	0	0	3
	Semester	II			

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 anda quote 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.
- Thiswill 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 needof 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	Lecture Hrs:09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT

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COURSE STRUCTURE & SYLLABI

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 Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.
6. 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-programming-languages

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	EXPERIMENTAL STRESS ANALYSIS	L	T	P	C
21D15202b	Program Elective Course – III	3	0	0	3
	Semester	II			

Course Objectives:

- To bring awareness on experimental method of finding the response of the structure todifferent 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	Lecture Hrs:09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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

UNIT - V	Lecture Hrs: 09

Three dimensional Photo elasticity : Introduction, locking in model deformation, materials forthree-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

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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

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COURSE STRUCTURE & SYLLABI

Course Code	THEORY OF PLASTICITY	L	T	P	C
21D15202c	Program Elective Course – III	3	0	0	3
	Semester	II			

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	Lecture Hrs:09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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	Lecture Hrs: 09

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.

UNIT - V	Lecture Hrs: 09

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

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:
1.https://mae.ufl.edu/nkim/egm6352/Chap4.pdf 2.https://ocw.mit.edu/resources/res-2-002-finite-element-procedures-for-solids-and-structures-spring-2010/nonlinear/lecture-17/ 3.https://www.youtube.com/watch?v=1ydR6LFFbhA 4.https://www.youtube.com/watch?v=nKVFDQpTCrs

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Course Code	MECHANICAL VIBRATIONS	L	T	P	C
21D15203a	Program Elective Course – IV	3	0	0	3
	Semester	II			

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		Lecture Hrs:9

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		Lecture Hrs:9

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		Lecture Hrs:9

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		Lecture Hrs:8

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

UNIT – V		Lecture Hrs:8

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.

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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:
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

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Course Code	DESIGN FOR MANUFACTURING	L	T	P	C
21D15203b	Program Elective Course – IV	3	0	0	3
Semester		II			

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 a range of current industrial processes and practices used to manufacture products in high and low volumes. Focus in depth on a few selectedprocesses.
- Apply physics to understand the factors that control the rate of production and influencethe quality, cost and flexibility of processes.
- Understand the impact of manufacturing constraints on product design and processplanning.
- Apply an understanding of variation to the factors that control the production rate andinfluence the quality, cost and flexibility of processes and systems.

Course Outcomes (CO): Student will be able to

- 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 to go 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		Lecture Hrs:09

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		Lecture Hrs: 09

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		Lecture Hrs: 09

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		Lecture Hrs: 09

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		Lecture Hrs: 09

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:

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1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd,

Reference Books:

1. ASM Hand book Vol.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

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COURSE STRUCTURE & SYLLABI

Course Code	PRESSURE VESSEL DESIGN	L	T	P	C
21D15203c	Program Elective Course – IV	3	0	0	3
	Semester	II			

Course Objectives:

- To give exposure to various types of process equipments and their design.
- To understand the different types of stresses and their effects in pressure vessel.
- To understand the piping layout and the stresses acting on it.

Course Outcomes (CO): Student will be able to

- Analyse thin plates and shells for various types of stresses.
- Design shells, end closures and nozzles ofpressure vessels using ASME codes.
- Analyse piping systems.

UNIT - I Lecture Hrs: 09

Introduction: Materials-shapes of Vessels-stresses in cylindrical, spherical and arbitrary, shaped shells. Cylindrical Vessels subjected to internal pressure, wind load, bending and torque-ilation of pressure vessels-conical and tetrahedral vessels.
Theory of thick cylinders: Shrink fit stresses in built up cylinders-auto frettage of thick cylinders. Thermal stresses in Pressure Vessels.

UNIT - II Lecture Hrs: 09

Theory of rectangular plates: Pure bending-different edge conditions.
Theory circular plates: Simple supported and clamped ends subjected to concentrated and uniformly distributed loads-stresses from local loads. Design of dome bends, shell connections, flat heads and cone openings.

UNIT - III Lecture Hrs: 09

Discontinuity stresses in pressure vessels: Introduction, beam on an elastic foundation, infinitely long beam, semi infinite beam, cylindrical vessel under axially symmetrical loading, extent and significance of load deformations on pressure vessels, discontinuity stresses in vessels, stresses ina bimetallic joints, deformation and stresses in flanges.

UNIT - IV Lecture Hrs: 09

Pressure vessel materials and their environment: Introduction, ductile material tensile tests, structure and strength of steel, Leuder's lines, determination of stress patterns from plastic flow observations, behaviour of steel beyond the yield point, effect of cold work or strain hardening on the physical properties of pressure vessel steels, fracture types in tension, toughness of materials, effect of neutron irradiation of steels, fatigue of metals, fatigue crack growth, fatigue life prediction, cumulative fatigue damage, stress theory of failure of vessels subject to steady state and fatigue conditions.

UNIT - V Lecture Hrs: 09

Stress concentrations: Influence of surface effects on fatigue, effect of the environment and other factors on fatigue life, thermal stress fatigue, creep and rupture of metals at elevated temperatures, hydrogen embrittlement of pressure vessel steels, brittle fracture, effect of environment on fracture toughness, fracture toughness relationships, criteria for design with defects, significance of fracture mechanics evaluations, effect of warm prestressing on the ambient temperature toughness of pressure vessel steels.
Design features: Localized stresses and their significance, stress concentration at a variable thickness transition section in a cylindrical vessel, stress concentration about a circular hole in a plate subjected to tension, elliptical openings, stress concentration, stress concentration factors for superposition, dynamic and thermal transient conditions, theory of reinforced openings, nozzle reinforcement, placement and shape, fatigue and stress concentration

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Textbooks:
1. Theory and design of modern Pressure Vessels by John F.Harvey, Van nostrand reihold company, New York. 2. Pressure Vessel Design and Analysis by Bickell, M.B.Ruizcs.
Reference Books:
1. Process Equipment design- Beowll & Yound Ett. 2. Indian standard code for unfired Pressure vessels IS:2825. 3. Pressure Vessel Design Hand Book, Henry H.Bednar, P.E., C.B.S.Publishers, New Delhi. 4. Theory of plates and shells- Timoshenko & Noinosky.
Online Learning Resources:
1.https://www.youtube.com/watch?v=erW4HZ5I928 2.https://www.youtube.com/watch?v=Ja03J1RQ3Hw 3.https://www.youtube.com/watch?v=5-7ZoE1cBxY 4.https://www.youtube.com/watch?v=ZCzTBm2xFwg 5.https://www.youtube.com/watch?v=BfM8vQ3N9gw 6.https://www.youtube.com/watch?v=PChaq8Y1BGk

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	MACHINE DYNAMICS LABORATORY	L	T	P	C
21D15204		0	0	4	2
	Semester	II			

Course Objectives:

- Students able 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:

01. Natural frequency of simple pendulum
02. Determine the moment of inertia of a flywheel.
03. Determination of steady state amplitude of forced vibratory system
04. Natural frequency of single rotor system
05. Natural frequency of single rotor with damping
06. Undamped free vibrations of beam
07. Damped free vibrations of beam
08 Forced vibrations of beam.
09. 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. P Grover

Online learning resources/Virtual labs:

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COURSE STRUCTURE & SYLLABI

Course Code	MODELLING AND ANALYSIS LAB	L	T	P	C
21D15205		0	0	4	2
	Semester	II			

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 and 3-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 2D and 3D objects using a modeling software
- Solve structural problems using finite element software
- Execute mini project involving both modeling and analysis

List of Experiments:

01 Develop Programs for Transformations in CAD

02. Develop Programs for Synthetic Curves in CAD

03. Introduction to Pro/E and working with features like Extrude & Revolve in sketch mode

04. Model solids with features like Hole, Round, Chamfer and Rib

05. Model solids with features like Pattern, Copy, Rotate, Move and Mirror

06. Assembly modeling in Pro/E, Generating, editing and modifying drawings in Pro/E

07. Solution of Trusses problems using the developed code

08. Solution of Beams and Frames using the developed code

09. Solution of problems involving triangular element using the developed code

10. Solution of problems of Trusses using ANSYS

11. Solution of problems of Beams and Frames using ANSYS

12. Solution of problems involving triangular element etc. using ANSYS

References:

1. Lab manual

Online learning resources/Virtual labs:

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COURSE STRUCTURE & SYLLABI

Course Code	QUALITY CONCEPTS IN DESIGN	L	T	P	C
21D15301a	Program Elective Course – V	3	0	0	3
	Semester	III			

Course Objectives:

- To impart knowledge on various concepts in engineering design and principles of implementing quality in a product or service through tools such as quality houses, control charts, statistical process control method, failure mode effect analysis and various strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.
- To gather knowledge on fundamentals of design and its methods, robust design, embodiment principles, various methods in design of experiments, reliability, statisticaltools and six sigma techniques.

Course Outcomes (CO): Student will be able to

- Understand the design cum quality concepts.
- Get familiarized with various concepts indesign, quality and reliability principles in the design of an engineering product or aservice.

UNIT - I — Lecture Hrs: 09

DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION

Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering – Competition Bench Marking – Creativity – Theory of Problem solving (TRIZ) – Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging, Metal Forming, Machining and Welding

UNIT - II — Lecture Hrs: 09

DESIGN FOR QUALITY

Quality Function Deployment -House of Quality-Objectives and functions-Targets- Stakeholders-Measures and Matrices-Design of Experiments –design process- Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design –testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.

UNIT - III — Lecture Hrs: 09

FAILURE MODE EFFECT ANALYSIS AND DESIGN FOR SIX SIGMA

Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method-linking fault states to systems modeling - Basis of SIX SIGMA

–Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services

UNIT - IV — Lecture Hrs: 09

DESIGN OF EXPERIMENTS

Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments

- Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, 2K factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi'sapproach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios.

UNIT - V — Lecture Hrs: 09

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

STATISTICAL CONSIDERATION AND RELIABILITY

Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3-D plots.- Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distribution

Textbooks:

1. Dieter, George E., "Engineering Design - A Materials and Processing Approach", McGraw Hill, International Editions, Singapore, 2000.
2. Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.
3. Product Design And Development, KARL T. ULRICH, STEVEN D. EPPINGER,TATA Mc GRAW-HILL- 3rd Edition, 2003.

Reference Books:

1. The Management and control of Quality-6th edition-James R. Evens, William M Lindsay Pub:son south-western(www.swlearning.com)
2. Fundamentals of Quality control and improvement 2nd edition, AMITAVA MITRA,Pearson Education Asia, 2002.
3. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
4. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

Online Learning Resources:

1.https://www.youtube.com/watch?v=uQTUXGeuuuY
2.http://home.iitk.ac.in/~shalab/course2.htm
3.https://nptel.ac.in/courses/111/104/111104075/
4.https://www.youtube.com/watch?v=TBuFo6My6Pc
5.https://www.youtube.com/watch?v=UN206cSaF0k
6.https://www.youtube.com/watch?v=sIRl1xWrViY

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M.TECH. IN MACHINE DESIGN
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Course Code	DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS (PE-V)	L	T	P	C
21D15301b		3	0	0	3
	Semester	III			

Course Objectives:

- Student will understand the methodology of basic and advanced design of pneumatics and hydraulics systems.
- Students get knowledge on the need, use and application of fluid power.

Course Outcomes (CO): Student will be

- Familiar to industrial design that lead to automation.
- Able to impartknowledge on the science, use and application of hydraulics and pneumatics.

UNIT – I		Lecture Hrs:09

OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT – II		Lecture Hrs: 09

CONTROL AND REGULATION ELEMENTS
Pressure - direction and flow control valves - relief valves, non-return and safety valves -actuation systems.

UNIT – III		Lecture Hrs: 09

HYDRAULIC CIRCUITS
Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components - safety andemergency mandrels.

UNIT – IV		Lecture Hrs: 09

PNEUMATIC SYSTEMS AND CIRCUITS
Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits -switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

UNIT – V		Lecture Hrs: 09

INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS
Pneumatic equipments- selection of components - design calculations – application -faultfinding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

Textbooks:

1. Andrew Parr, “Hydraulic and Pneumatics” (HB), Jaico Publishing House, 1999.
2. Bolton. W., “Pneumatic and Hydraulic Systems “, Butterworth –Heinemann, 1997.

Reference Books:

1. Antony Espossito, “Fluid Power with Applications”, Prentice Hall, 1980.
2. Dudleyt, A. Pease and John J. Pippenger, “Basic fluid power”, Prentice Hall, 1987.
3. K.Shanmuga Sundaram, “Hydraulic and Pneumatic Controls: Understanding made Easy"S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009).

Online Learning Resources:

1.https://nptel.ac.in/courses/112/103/112103249/
2.https://nptel.ac.in/courses/112/106/112106175/
3.https://nptel.ac.in/content/storage2/courses/112106175/Module%201/Lecture%201.pdf
4.https://www.vidyarthiplus.com/vp/attachment.php?aid=18972
5.https://snscourseware.org/snscenew/notes.php?cw=CW_5e27ec3b0457a

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	APPLIED ENGINEERING ACOUSTICS	L	T	P	C
21D15301c	Program Elective Course – V	3	0	0	3
	Semester	III			

Course Objectives:

- To impart knowledge on the fundamentals of acoustics, its characteristics, its transmission in different media, usage of sound measuring instruments and the various sound control methods.

Course Outcomes (CO): Student will be

- At the end of this course, the students would be in a position to understand the basics of sound engineering.
- Understand working principle of sound measuring equipments and different ways of acoustic control in the engineering field.

UNIT – I | Lecture Hrs:09

BASIC CONCEPTS OF ACOUSTICS

Scope of Acoustics – Sound pressure – Sound intensity – Sound power level Sound power – Wave motion – Alteration of wave paths –Measurement of sound waves – sound spectra – Sound fields – Interference – Standing waves – Acoustic energy density and intensity –Specific acoustic impedance.

UNIT – II | Lecture Hrs: 09

CHARACTERISTICS OF SOUND

One dimensional wave equation – Solution of 1D wave equation – Velocity in gaseous medium – Velocity of plane progressive sound wave through a thin solid rod – Velocity of plane wave in a bulk of solid – Transverse wave propagation along a string stretched under tension – Wave equation in two dimension.

UNIT – III | Lecture Hrs: 09

TRANSMISSION PHENOMENA

Changes in media – Transmission from one fluid medium to another, normal incidence, oblique incidence - Reflection at the surface of a solid, normal incidence, oblique incidence – Standing wave pattern – Transmission through three media.

UNIT – IV | Lecture Hrs: 09

INTRODUCTION TO THE ASSESSMENT AND MEASUREMENT OF SOUND

Introduction – Decibel scale for the measurement of sound power – Sound level meter – Weighted sound pressure level – Equal Loudness contours – Perceived noisiness – Loudness, Loudness level, perceived noise, perceived noise level – Equivalent sound level – Identified level – Frequency and Amplitude measurement.

UNIT – V | Lecture Hrs: 09

BASICS OF NOISE CONTROL

Noise Control at source, path, receiver – Noise control by acoustical treatment – Machinery noise – Types of machinery involved – Determination of sound power andsound power level – Noise reduction procedures – Acoustic enclosures.

Textbooks:

1. Lawrence E. Kinsler, Austin R. Frey, "Fundamentals of Acoustics "– John Wiley andSons Inc., 1986.
2. Bies, David, A. and Hansen, Colin H., "Engineering Noise Control – Theory andPractice", E and FN Spon, Chapman-Hall, Second Edition, 1996

Reference Books:

1.Hansen C.H. and Snyder, S.D., "Active Control of Sound and Vibration", E and FNSpon, London 1996.

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Online Learning Resources:
1.https://nptel.ac.in/courses/112/104/112104212/ 2.https://en.wikipedia.org/wiki/Acoustical_engineering 3.https://en.wikibooks.org/wiki/Engineering_Acoustics 4.https://youtu.be/W5EzDbTK1OY 5.https://youtu.be/YlEkwNmdCoM 6.https://nptel.ac.in/courses/112/104/112104026/

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

AUDIT COURSE-I

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
21DAC101a		2	0	0	0
	Semester	I			

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): Student 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 - I		Lecture Hrs:10
1Overview 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 - II		Lecture Hrs:10
Essential Components of a Research Paper- Abstracts- Building Hypothesis-Research Problem - Highlight Findings- Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization		
UNIT - III		Lecture Hrs:10
Introducing Review of the Literature – Methodology - Analysis of the Data-Findings - Discussion-Conclusions-Recommendations.		
UNIT - IV		Lecture Hrs:9
Key skills needed for writing a Title, Abstract, and Introduction		
UNIT - V		Lecture Hrs:9
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'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	DISASTER MANAGEMENT	L	T	P	C
21DAC101b		2	0	0	0
	Semester	I			

Course Objectives: This course will enable students:

- Learn to demonstrate critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluatedisasterriskreduction and humanitarian response policy and practice from
- Multiple perspectives.
- Developanunderstandingofstandardsofhumanitarianresponseandpracticalrelevanceinspecific types of disasters and conflict situations
- Criticallyunderstandthestrengthsandweaknessesofdisastermanagementapproaches,planningand programming in different countries, particularly their home country or the countries they work in

UNIT - I

Introduction:
Disaster:Definition,FactorsandSignificance;DifferenceBetweenHazardandDisaster;Naturaland 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 - II

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

UNIT - III

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

UNIT - IV

Risk Assessment Disaster Risk:
Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. TechniquesofRiskAssessment,GlobalCo-OperationinRiskAssessmentand Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT - V

Disaster Mitigation:
Meaning,ConceptandStrategiesofDisasterMitigation,EmergingTrendsInMitigation.Structural Mitigationand Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Reading

1. R.Nishith,SinghAK,"DisasterManagementinIndia:Perspectives,issuesandstrategies
2. "'New Royal book Company..Sahni,PardeepEt.Al.(Eds.),"DisasterMitigationExperiencesAndReflections",PrenticeHall OfIndia, New Delhi.
3. GoelS.L.,DisasterAdministrationAndManagementTextAndCaseStudies",Deep&Deep Publication Pvt. Ltd., New Delhi

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	**SANSKRITFOR TECHNICAL KNOWLEDGE**	**L**	**T**	**P**	**C**
21DAC101c		**2**	**0**	**0**	**0**
	Semester	**I**			

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
- LearningofSanskrittodevelopthelogicinmathematics,science&othersubjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge
- Knowledge from ancientliterature

Course Outcomes (CO): Student 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 - I		
Alphabets in Sanskrit,		
UNIT - II		
Past/Present/Future Tense, Simple Sentences		
UNIT - III		
Order, Introduction of roots		
UNIT - IV		
Technical information about Sanskrit Literature		
UNIT - V		
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- VempatiKutumbshastri, RashtriyaSanskrit Sansthanam, New Delhi Publication
3.“India’s Glorious ScientificTradition” Suresh Soni, Ocean books (P) Ltd.,New Delhi

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M.TECH. IN MACHINE DESIGN
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AUDIT COURSE-II

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	PEDAGOGY STUDIES	L	T	P	C
21DAC201a		2	0	0	0
	Semester	II			

Course Objectives: This course will enable students:

- Reviewexistingevidenceonthereviewtopictoinformprogrammedesignandpolicy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes (CO): Student will be able to

- Students will be able to understand:
- Whatpedagogicalpracticesarebeingusedbyteachersinformalandinformalclassrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what
- conditions, and with what population of learners?
- Howcanteachereducation(curriculumandpracticum)andtheschoolcurriculumand guidance materials best support effective pedagogy?

UNIT - I

Introduction and Methodology: Aims and rationale, Policy back ground, Conceptual frame work and terminology Theories oflearning,Curriculum,Teachereducation.Conceptualframework,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 theeffectivenessofpedagogicalpractices,Methodologyfortheindepthstage:quality assessmen t of included studies. How can teacher education (curriculumandpracticum) andthescho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of th 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
teacherandthecommunity.Curriculumandassessment,Barrierstolearning:limitedresourcesand large class sizes

UNIT - V

Researchgapsandfuturedirections:Researchdesign,Contexts,Pedagogy,Teachereducation, Curriculum and assessment, Dissemination and research impact.

Suggested Reading

1. AckersJ,HardmanF(2001)ClassroominteractioninKenyanprimaryschools,Compare, 31 (2): 245-261.
2. AgrawalM(2004)Curricularreforminschools:Theimportanceofevaluation,Journalof
3. Curriculum Studies, 36 (3): 361-379.
4. AkyeampongK(2003) Teacher training in Ghana - does it count? Multi-site teachereducation research project (MUSTER) country report 1. London: DFID.
5. Akyeampong K, LussierK, PryorJ, Westbrook J (2013)Improving teaching and learning of basic maths and reading in Africa: Does teacherpreparation count?International Journal Educational Development, 33 (3): 272–282.

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6. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
Chavan M (2003)ReadIndia: A mass scale, rapid, 'learning to read'campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	STRESSMANAGEMENT BY YOGA	L	T	P	C
21DAC201b		2	0	0	0
	Semester	**II**			

Course Objectives: This course will enable students:

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

Course Outcomes (CO): Student will be able to

- 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`sand Don't'sin life. i) Ahinsa,satya,astheya,bramhacharyaand aparigrahaii) Shaucha,santosh,tapa,swadhyay,ishwarpranidhan		
UNIT - IV		
Asan and Pranayam		
UNIT - V		
i)Variousyogposesand theirbenefitsformind &body ii)Regularizationofbreathingtechniques and its effects-Types ofpranayam		

Suggested Reading

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

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COURSE STRUCTURE & SYLLABI

Course Code	PERSONALITY DEVELOPMENT THROUGHLIFE	L	T	P	C
21DAC201c	ENLIGHTENMENTSKILLS	2	0	0	0
	Semester	II			

Course Objectives: This course will enable students:

- 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 (CO): Student will be able to

- StudyofShrimad-Bhagwad-Geetawillhelpthestudentindevelopinghispersonalityand achieve the highest goal in life
- The person who has studied Geetawilllead 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.
ShrimadBhagwadGeeta: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."SrimadBhagavadGita"bySwamiSwarupanandaAdvaitaAshram(PublicationDepartment), Kolkata
2.Bhartrihari'sThree Satakam (Niti-sringar-vairagya) by P.Gopinath, RashtriyaSanskrit Sansthanam, New Delhi.

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OPEN ELECTIVE

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	BUSINESS ANALYTICS	L	T	P	C
21DOE301c		3	0	0	3
	Semester	**III**			

Course Objectives:

- The main objective of this course is to give the student a comprehensive understanding of
- business analytics methods.

Course Outcomes (CO): Student will be able to

- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on
- data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and
- prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT - I	Lecture Hrs:

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.

UNIT - II	Lecture Hrs:

Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

UNIT - III	Lecture Hrs:

Forming Requirements: Overview of Requirements, Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

UNIT - IV	Lecture Hrs:

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools

UNIT - V	Lecture Hrs:

Recent Trands in: Embedded and colleborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

Textbooks:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

Reference Books:

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

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M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

Course Code	**INTERNET OF THINGS (IOT)**	**L**	**T**	**P**	**C**
21DOE301g		**3**	**-**	**-**	**3**
	Semester	**III**			

Course Objectives: Student will be able

- To study fundamental concepts of IoT
- To understand roles of sensors in IoT
- To Learn different protocols used for IoT design
- To be familiar with data handling and analytics tools in IoT
- Appreciate the role of big data, cloud computing and data analytics in a typical IoT system

Course Outcomes (CO): Student will be able to

- Understand the various concepts, terminologies and architecture of IoT systems.
- Use sensors and actuators for design of IoT.
- Understand and apply various protocols for design of IoT systems
- Use various techniques of data storage and analytics in IoT
- Understand various applications of IoT
- Understand APIs to connect IoT related technologies

UNIT – I	Lecture Hrs:09

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M

UNIT – II	Lecture Hrs: 09

Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

UNIT – III	Lecture Hrs: 09

Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.
IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols

UNIT – IV	Lecture Hrs: 09

Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications

UNIT - V	Lecture Hrs: 09

Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Textbooks:

1.Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Wiley Publications
2.Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3.Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
4.J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
5.Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design

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and Test", Application Note, 2016.
Reference Books:
1.Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publication 2.Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
Online Learning Resources:
https://onlinecourses.nptel.ac.in/noc17_cs22/course http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

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Course Code	MECHATRONICS	L	T	P	C
21DOE301h		3	0	0	3
	Semester	III			

Course Objectives: Student will be able

- To study fundamental concepts of Signal condition
- To understand the concepts of precision mechanical systems
- To Learn different electronic interface subsystems
- To be familiar with microcontrollers overview.
- To understand the concepts of programmable logic controllers

Course Outcomes (CO): Student will be able to

- Understand the various concepts, terminologies of Signal condition
- Understand the basics electronic interface subsystems
- Understand and apply various precision mechanical systems
- Understand various applications of microcontrollers overview
- Understand the controlling of programmable logic and programmable motion.

UNIT – I		Lecture Hrs:09

INTRODUCTION : Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

SIGNAL CONDITIONING : Introduction – Hardware - Digital I/O, Analog input – ADC, resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , high pass , notch filtering.

UNIT – II		Lecture Hrs: 09

PRECISION MECHANICAL SYSTEMS : Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

UNIT – III		Lecture Hrs: 09

ELECTRONIC INTERFACE SUBSYSTEMS : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isoation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

ELECTROMECHANICAL DRIVES : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation

UNIT – IV		Lecture Hrs: 09

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure - DigitalInterfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly , C (LED Blinking , Voltage measurement using ADC).

UNIT - V		Lecture Hrs: 09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

M.TECH. IN MACHINE DESIGN
COURSE STRUCTURE & SYLLABI

PROGRAMMABLE LOGIC CONTROLLERS : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application. **PROGRAMMABLE MOTION CONTROLLERS** : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices :Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive ,
Textbooks:
1. A text book of Mechatronics by Er.R.K. RAJPUT ., S.CHAND publications 2. A text book of Mechatronics by Nitalgour Premchand Mahalik ., McGraw Hill publications
Reference Books:
1. A text book of Mechatronics by W.Bolton ., Pearson Publications