SCHOOL OF ENGINEERING AND TECHNOLOGY

SRI PADMAVATI MAHILA VISVAVIDYALAYAM
(WOMEN'S UNIVERSITY)

Department of Mechanical Engineering
M.TECH Scheme and Syllabus – R19

(In accordance with AICTE Model Curriculum)

Accredited by NACC with "A" Grade

SCHOOL OF ENGINEERING AND TECHNOLOGY

SRI PADMAVATI MAHILA VISVAVIDYALAYAM
(WOMEN'S UNIVERSITY)

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

MMET01: ADVANCED MECHANISMS

Credits -3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Provide basic concept of kinematics and kinetics of machine elements.
2. Ability to analyze and interpret data of degree of freedom and degree of movability of mechanisms.
3. Study how velocity and acceleration of linkages changes with the position with reference to change position of points by different methods.
4. Study about the Synthesis-Analytical Method, Synthesis-Graphical Method
5. Study about Robotics Concepts

Course Outcomes

After successful completion of course the student should be able to

CO1. Solve and analyze the advanced kinematics problems.
CO2. Draw Burmester curve of various mechanisms by graphical method.
CO3. Understand the basic concepts of robotics including kinematics.
CO4. Able to analyze simple and complex mechanisms
CO5. Apply kinematic theories to real-world problems of mechanism design and synthesis

UNIT I

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

UNIT II

Advanced Kinematics of Plane Motion I: The Inflection circle ; Euler – Savary Equation; Analytical and graphical determination of d_i; 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.

Advanced Kinematics of Plane Motion II: Polode curvature; Hall's Equation; Polode curvature in the four bar mechanism; coupler motion; Relative motion of the output and input links; Determination of the output angular acceleration and its Rate of change; Freudenstein'scollineation–axis theorem; Carter Hall circle; The circling – point curve for the Coupler of a four bar mechanism.

UNIT III

Introduction to Synthesis-Graphical Methods I: 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. Introduction to Synthesis-Graphical Methods -II: Function generation-General discussion; Function generation: Relative–rotocenter method, Overlay's method, Function generation- Velocity – pole method; Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem.

UNIT IV

Introduction to Synthesis Analytical Methods: Function Generation: Freudenstien's equation, Precision point approximation, Precision – derivative approximation; Path Generation: 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.

Dr. P.Snehalatha	Prof. B. Bala Krishna	Prof. A.RamaKrishna Rao	
Co-ordinator (ME)		BoS Chairman (ME)	Director
SE&T		SE&T	

UNIT V

Manipulator Kinematics: D-H transformation matrix; Direct and Inverse kinematic analysis of Serialmanipulators: Articulated, spherical & industrial robot manipulators- PUMA, SCARA, STANFORD ARM,MICROBOT.

Text Books

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. Allen S.Hall Jr., “Kinematics and Linkage Design”, PHI, 1964.
2. J.E Shigley and J.J. Uicker Jr., “Theory of Machines and Mechanisms”, McGraw-Hill, 1995.
3. Joseph Duffy, “Analysis of mechanisms and Robot manipulators”, Edward Arnold, 1980.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			H	M			H	M	
CO2	M		L	M	H	M	L	L	M	L
CO3	M		M	H		H	L	M	H	
CO4	M		L	L	M	M	H	M	L	H
CO5			L	M	H	L	H	H	M	L

19MMET02:ADVANCED MECHANICS OF SOLIDS

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Enable the students to calculate stresses and strains generated in material due to external loads for various types of loading conditions.
2. Demonstrate and recognize the qualitative features of the stresses and strains in beams
3. Analyze the material properties and area properties associated with axial loading,torsion and bending.

Course Outcomes

After successful completion of course the student should be able to

CO1.Demonstrate Theories of stress and strain, various types of loading and stresses induced onbeams.
CO2. Knowledge on Failure criteria in structures.
CO3.Analyze the stresses induced in basic mechanical components.
CO4. Estimate the strain energy in mechanical elements.
CO5. Analyze the deflection of beams, stresses and strains in thick and thin cylinders.

UNIT I

Theories of Stress and Strain: Definition of stress at a point, stress notation, principal stresses, other properties, differential equations of motion of a deformable body, deformation of a deformable body, strain theory, principal strains, strain of a volume element, small displacement theory. Stress –strain temperature relations: Elastic and non-elastic response of a solid, first law of thermodynamics, Hooke's Law, Anisotropic elasticity, Hooke's Law, Isotropic elasticity, initiation of Yield, Yield criteria.

UNIT II

Failure Criteria: Modes of failure, Failure criteria, Excessive deflections, Yield initiation, fracture, Progressivefracture, (High Cycle fatigue for number of cycles $N > 10^6$), buckling. Application of energy methods: Elastic deflections and statically indeterminate members and structures: Principle of stationary potential energy, Castiglione's theorem on deflections, Castiglione's theorem on deflections for linear load deflection relations, deflections of statically determinate structures.

UNIT III

Unsymmetrical Bending: Bending stresses in Beams subjected to Nonsymmetrical bending; Deflection of straight beams due to nonsymmetrical bending. 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.

UNIT IV

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

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

UNIT V

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.

TextBooks

1. Boresi& Richard J. Schmidt, "Advanced Mechanics of materials" ,Wiely International, 6thEdition.
2. Timoschenko S.P. and Goodier J.N, "Theory of elasticity", by McGraw-Hill Publishers 3rd Edition
3. L.S Srinath, "Advanced Mechanics of Solids", Tata MC Grw-Hill Education, 2009.

Reference Books

1. Den Hortog J.P., "Advanced strength of materials",Doyer Publication, 1st Edition.
2. B.CPunmia, "Strength of materials & Theory of structures (Vol I & II)", Laxmi Publications.
3. Sadhu singh, "Strength of materials", Khanna Publisher, 5th Edition.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			H	M			L	M	
CO2			M	M	H	M	M	M	H	M
CO3	M		L	H		H	L	M	H	
CO4				M	M			H	M	L
CO5	M		L	M	H	H	H	H	M	L

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET03: MECHANICAL VIBRATIONS

Credits –4 **Sessional Marks: 30**
L:T:P :: 3:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Acquire knowledge of fundamental concepts of mechanical vibration and analysis.
2. Understand and appreciate the importance of vibrations in mechanical design of machine parts that operates in damped vibratory conditions.
3. Determine the effect of forced vibration and motion transmissibility.
4. Analyze the effect of Vibration Measuring Instruments for different applications.
5. Understand the effect of multi degree freedom system by different methods.

Course Outcomes

After successful completion of course the student should be able to

CO1. Appreciating the need and importance of vibration analysis in mechanical design of machine parts that operate in undamped vibratory conditions.

CO2. Understand the concept of vibration to represent a system as a set of masses, springs and dampers to evaluate the vibration characteristics in damped conditions,

CO3. Analytically solve the equations of motion for harmonic excitation, base excitation and force transmission in single degree of freedom systems.

CO4.Investigate the whirling problem on a rotating shaft and develop vibration isolators for harmonic shock loadings.

CO5.Understand the concepts of vibration modes and natural frequencies and their measurement and estimation for two degree of freedom systems and multi degree of freedom systems.

UNIT I

Single degree of Freedom systems: Undamped and damped free vibrations, forced vibrations coulombdamping; 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

Multi degree freedom systems: Principal modes–undampedanddamped free and forced vibrations ;undamped vibration absorbers, 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 iteration; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

UNIT III

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

UNIT IV

Experimental Methods: Vibrometers, velocity meters & accelerometers.

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

UNIT V

Application of Concepts: Free vibration of strings–longitudinaloscillations of bars-transverse vibrations ofbeams- Torsional vibrations of shafts, Critical speeds without and with damping, secondary critical speed.

Text Books

1. LeohardMeirovitch, "Elements of Vibration Analysis" MC Graw Hill Publication, 2nd Edition.
2. G.K. Groover, "Mechanical Vibrations", MC Graw Hill Publication, 8th Edition.

Reference Books

1. S. GrahamKelly ,"Mechanical Vibrations" , Schaum series.
2. V.Ram Murthy, "Mechanical Viabrations", Narosa Publications.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			H	M			L	M	
CO2			L	H	H	M	M	L	H	M
CO3	M			M		H	L	H	M	
CO4	M		M	L	M	H		M	H	L
CO5			L	L	H	H	H	H	M	M

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET07: THEORY OF ELASTICITY & PLASTICITY

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Understand the basic concepts of Equilibrium, Principal stresses and their directions, normal and shear stress on octahedral planes.
2. Know the concept of strain and displacement, strain displacement relations and compatibility conditions.
3. Understand the concept of principal stress and their directions.
4. Develop stress- strain relation using elastic constants and understand St.Venants and super position principle.
5. Analyzes the concepts of flow rule Drucker ‘s stability postulate.
6. Understand the concept of Incremental stress strain relationships.

Course Outcomes

After successful completion of course the student should be able to

CO1: Derive equations of Equilibrium for 2D and 3D state of stress, estimation of principal stress and its directions; calculate of normal and shear stress on octahedral plane.

CO2: Develop the strain displacement and compatibility equations, principal strains and its directions, determination of strains in arbitrary planes.

CO3: Describe stress-strain relations, estimate of Lame’s constant for different types of materials. Apply super position, Reciprocal and Saint vents principles to estimate stress and strain.

CO4: Understand the deformation theory of plasticity.

CO5: Know the uniqueness considerations of elastic-plastic materials.

UNIT I

Definition And Notation: Stress, Stress at a Point, Equilibrium Equations, Principal Stresses, Mohr‟sDiagram, Maximum Shear Stress, Boundary Conditions.

UNIT II

Strain at a Point: Compatibility Equations, Principal Strains, Generalized Hooke‟s law, Methods ofSolution of Elasticity Problems – Plane Stress-Plane Strain Problems.Cauchy‟s formulae for strains,principal shear strains, derivative strain tensor.

UNIT III

Introduction: Modeling Uniaxial behavior in plasticity. Index notation, Cartesian tensors. Yield andfailure 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 IV

Principle of virtual work and its rate forms: Drucker‟s stability postulate, normality, convexity anduniqueness for an elastic solid. Incremental stress strain relations.

Criteria for loading and unloading: Elastic and plastic strain increment tensors, Plastic potential andflow rule associated with different Yield criteria, Convexity, normality and uniqueness considerations for elastic–plastic materials. Expansion of a thick walled cylinder.

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

UNIT V

Incremental Stress Strain Relationships: Prandtl-Reuss material model. J_2deformation theory,Drucker-Prager material, General Isotropic materials.

Deformation Theory of Plasticity: Loading surface, Hardening rules. Flow rule and Druckers stabilitypostulate. Concept of effective stress and effective strain, mixed hardening material. Problems.

Text Books

1. S.P. Timoshenko & J.K Goodier, "Theory of Elasticity",by MGH.
2. L. S. Srinath, "Advanced Mechanics of solids", Tata Mc. Graw Hill, 2003.

Reference Books

1. Dr. Sadhu Singh, "Theory of Elasticity" ,Khanna Publications, 1988.
2. Martin H Sadd, "Elasticity, Theory, Applications &Numericals", Elsevier. 2005.
3. C.T. WANG "Applied Elasticity", TataMc. Graw Hill Book Co.
4. W.F.Chen s and D.J.Han,"Plasticity for structural engineering", Springer verlag-1987.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			H	M			L	M	
CO2	M		L	H	L	L	L	L	L	L
CO3			L	H		M	L		L	
CO4	M		M	L	H	L	M	M	M	M
CO5			L	M	H	H	H	H	L	L

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET08:FATIGUE, CREEP & FRACTURE MECHANICS

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Understanding and significance of the principles of fracture mechanics,fatigue and creep.
2. Ability to employ these principles in fracture based design.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the different modes of failures like fracture, fatigue and creep of ductile and brittle materials.
CO2. Analyze the linear elastic and elasto-plastic fracture mechanics and formulate the stress intensity factor for typical crack configurations.
CO3. Understand the different fatigue cycle and consideration of factors enhancing fatigue resistance.
CO4. Learn about basic mechanisms behind creep and how to model creep.

UNIT I

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 un notched components. Fracture at elevated temperature.

UNIT II

Griffith's Analysis: Concept of energy release rate, G, and fracture energy, R. Modification for ductile materials, loading conditions. Concept of R curves.

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.

UNIT III

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.

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

UNIT IV

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

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

UNIT V

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

Text Books

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 edition, 1993.
3. J.F. Knott, "Fundamentals of Fracture Mechanics", Butterworths, 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.
5. F.R.N. Nabarro, H.L. deVilliers, "The Physics of Creep", Taylor and Francis,1995.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M			H				H		
CO2	M	H				M			H	
CO3	H							M		
CO4				H					M	

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET09: TRIBOLOGICAL SYSTEMS DESIGN

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Apply the basic theories of friction, wear and lubrication to predictions about the frictional behavior of commonly encountered sliding interfaces.
2. Characterize features of rough surface and liquid lubricants as they pertain to interface sliding.
3. Interpret the latest research on new topics in tribology including its application to nanoscale devices and biological systems.

Course Outcomes

After successful completion of course the student should be able to

CO1. Analyze properties of lubricant and select proper lubricant for a given application.
CO2. Determine tribological performance parameters of sliding contact in different lubrication regimes.
CO3. Design and select appropriate bearings for a given application
CO4. Predict the type of wear and volume of wear in metallic and non metallic surfaces.
CO5. Analyse the type of wear and volume of wear in non metallic surfaces.

UNIT I

Historical background : Viscosity - Viscometry - Effect of temperature on viscosity - Effect of pressure in viscosity - Other physical properties of mineral oils –Thegeneralized Reynolds equation - Flow and shear stress - The energy equation –Theequation of state - Mechanism of pressure development.

UNIT II

Circumferential Flow: Oil flow through a bearing having a circumferential oil groove -Heat generation and lubricant temperature - Heat balance and effective temperature -Bearing design: Practical considerations - Design of journal bearings - Parallel surfacebearing - Step bearing - Some situations under squeeze film lubrication - The mechanismof hydrodynamic instability - Stiffness and damping coefficients - Stability.

UNIT III

ElastohydrodynamicLubrication: Theoretical consideration - Grubin type solution -Accurate solution - Point contact - Dimensionless parameters - Film thickness equations -Different regimes in EHL contact - Deep-groove radial bearings - Angular contactbearings - Thrust ball bearings - Geometry - Kinematics - Stress and deformations –Loadcapacity.

UNIT IV

Surface Topography: Surface characterization - Apparent and real area of contact -Derivation of average Reynolds equation for partially lubricated surface - Effect ofsurface roughness on journal bearings

UNIT V

Laws of Friction : Friction theories - Surface contaminants - Frictional heating - Effect ofsliding speed on friction - Classification of wear - Mechanisms of wear –Quantitativelaws of wear - Wear resistance materials.

Text Books

1. Stachowaik, G.W., Batchelor, A.W., "Engineering Tribology", 3rd Ed., Elsevier, 2010.
2. Majumdar B.C, "Introduction to bearings", S. Chand & Co., Wheeler publishing, 1999.
3. Andras Z. Szeri, "Fluid film lubrication theory and design", Cambridge University press, 1998.

Reference Books

1. Majueprmdar, "Introduction to Tribology of Bearings", B.C.
2. Neale MJ, "Tribology Hand Book", CBS Publications, 2012.
3. Williams JA, "Engineering Tribology", Oxford Univ. Press, 2001.
4. Cameron A, "Basic lubrication theory", Ellis Horwood Ltd., 2002.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M							H		
CO2	M	H	H						H	
CO3	H		M					M		
CO4									M	

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET10: GEOMETRIC MODELLING

Credits – 3 | **Sessional Marks: 30**
L:T:P ::3:0:0 | **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. This course is to teach the theory and tools of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) with an emphasis on the central role of the geometric model in their seamless integration.
2. It focuses on the integration of these tools and the automation of the product development cycle.
3. It is to introduce geometric modeling techniques, data structure design and algorithms for solid Modeling..
4. It also covers the machining theory, automated CNC machining, and process control.

Course Outcomes

After successful completion of course the student should be able to

CO1. Explain the concepts and underlying theory of modeling and the usage of models in different engineering applications

CO2. Create accurate and precise geometry of complex engineering systems and use the geometric models in different engineering applications.

CO3. Compare the different types of modeling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development .

CO4. Use and assess commercial CAD/CAM tools efficiently, effectively and intelligently in advanced engineering applications.

CO5. Extend CAD/CAM technology for research and development purposes.

UNIT I

Introduction: Definition, Explicit and implicit equations, parametric equations.

UNIT II

Cubic Splines: Algebraic and geometric form of cubic spline, tangent vectors, parametric space of a curve, blending functions, four point form, reparametrization, truncating and subdividing of curves. Graphic construction and interpretation, composite pc curves.

UNIT III

Bezier Curves: Bernstein basis, equations of Bezier curves, properties, derivatives.

B-Spline Curves: B-Spline basis, equations, knot vectors, properties and derivatives.

UNIT IV

Surfaces: Bicubic surfaces, Coon's surfaces, Bezier surfaces, B-Spline surfaces, surfaces of revolutions, Sweep surfaces, ruled surfaces, tabulated cylinder, bilinear surfaces, Gaussian curvature.

UNIT V

Solids: Tricubic solid, Algebraic and geometric form.

Solid Modeling Concepts: Wire frames, Boundary representation, Half space modeling, spatial cell, cell decomposition, classification problem.

Dr. P.Snehalatha | Prof. B. Bala Krishna | Prof. A.RamaKrishna Rao
Co-ordinator (ME) | BoS Chairman (ME) | Director
SE&T | SE&T

Text Books

1. Ibrahim Zeid, “CAD/CAM Theory and Practice”,Tata McGraw-Hill, 1991.
2. Roger & Adams, “Elements of Computer Graphics”, Tata McGraw Hill.

Reference Books

1. Micheal E. Mortenson, “Geometric Modeling”, McGraw Hill Publishers
2. K.LalitNarayan, K.Mallikarjuna Rao, “Computer Aided Design and Manufacturing”, MMM Sarcar, PHI Publishers.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO – PO – PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1					H		M	H	M	M
CO2	M		H					M		M
CO3			M			M				
CO4				H	M			M		
CO5	M		M					M		

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MBST01:RESEARCH METHODOLOGY AND IPR

Credits – 3 | **Sessional Marks: 30**
L:T:P ::3:0:0 | **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Gaining familiarity in order to obtain insights into selected area of research
2. Procedures and techniques used to find the results of a research problem
3. Methods for data analysis and design
4. Steps to collect information about IPR
5. IPR protection strategies and other facilities provided by R &D in case of new innovation

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the research problem formulation

CO2. Analyze research related information

CO3. Follow research ethics

CO4. Understand that today's world is controlled by computer, information technology but tomorrow world will be ruled by ideas, concept and creativity.

CO5. Understand that when IPR would take such important place in growth of individuals and nation, it is needless to emphasis the need of information about intellectual property rights to be promoted among students in general and engineering in particular.

CO6. 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 intern brings about economic growth and social benefits.

UNIT I

Meaning Of Research Problem:Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II

Effective Literature Studies Approaches: Analysis Plagiarism, Research ethics,Effective technical writing, how to write report, PaperDeveloping a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III

Design and Analysis of Experiments: Introduction to ANOVA with examples, Factorial design:2^ndesign, Taguchi method:Introduction and application of taguchi method for optimization of process.

UNIT IV

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

Dr. P.Snehalatha Co-ordinator (ME) SE&T	Prof. B. Bala Krishna Prof. A.RamaKrishna Rao BoS Chairman (ME) SE&T	Director

UNIT V

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

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Softwareetc, Traditional knowledge Case Studies, IPR and IITs.

Text Book

1. Stuart Melville and Wayne Goddard, “Research methodology: An Introduction for Science & Engineering Students”, Juta Academic, 1996.

Reference Books

1. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”, Second Edition, Juta Academic, 2001
2. Ranjit Kumar, “Research Methodology: A Step by Step Guide for Beginners”, Fourth Edition, Sage Publications Ltd., 2014
3. Debora J. Halbert, “Resisting Intellectual Property”, Routledge, 2006.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, Third Edition, Aspen Law and Business, 2003.
5. T. Ramappa, “Intellectual Property Rights Under WTO: Tasks before India”, A H Wheeler Publishing Co Ltd., 2002

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H									L
CO2		M								
CO3			H							
CO4	M									L
CO5		H								
CO6			M							L

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMEP01: MACHINE DYNAMICS LAB

Credits – 1 **Sessional Marks: 40**
L:T:P :: 0:0:2 **University Exam Marks: 60**

Course Objectives
To expose the students to the following
1. Equip students with understanding of the fundamental principles and techniques for Identify different types of dynamic systems and classify them by their governing equations.
2. Develop a model of a mechanical system using a free body diagram.
3. Analyze equations of motion for translational and rotational mechanical systems.

Course Outcomes
After successful completion of course the student should be able to
CO1. State the mode shapes of the 1DOF forced vibration systems.
CO2. Describe the equations of motions of forced damped vibration systems both analytical and graphical methods.
CO3.Analyze natural frequency of multi degrees of systems.
CO4. Estimate the natural frequencies of continuous systems.
CO5. Calculate speed of the governor, jump seed by cam profile.

List of Experiments
Any 8 of the following experiments

1. To investigate the relation $T = 2\pi \sqrt{L / g}$ for simple pendulum.
2. To determine Radius of Gyration of the given compound pendulum.
3. To verify the theoretical frequency of the longitudinal vibrations of a spring mass system with experimental frequency.
4. To compare the experimental frequency of the un damped free vibrations of an equivalent spring mass system with the Theo. Frequency
5. To study forced vibrations of an equivalent spring mass system.
6. To compare the theoretical frequency of the torsional vibrations (undamped) of a single rotor system with experimental frequency.
7. To study free vibrations of a two rotor system and determine the natural frequency.
8. To study the phenomena of whirling of shafts and find the critical speed.
9. To verify the Dunkerley's rule.
10. Study of vibration measuring instrument.
11. To study the gyroscopic behavior of a spinning rod.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS01	PSO2	PSO3
CO1	H			L		L	M	M	L	M
CO2	M		L	M		M	L		M	L
CO3	M		M	M		H	L	L	H	L
CO4				H	M	M	H	L	M	
CO5			L	H	H	L	H	H		L

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

Dr. P.Snehalatha	Prof. B. Bala Krishna	Prof. A.RamaKrishna Rao	
Co-ordinator (ME)	BoS Chairman (ME)		Director
SE&T	SE&T		

19MMET04: ADVANCED FINITE ELEMENT METHOD

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Enable the student to analyze the engineering problems in the design process of solids and their structures.
2. Make the students to apply the knowledge of mathematics, science and engineering to do the analysis of simple and complex elastic structures using the finite element analysis.
3. Derive the finite element equations for different mechanical elements.
4. Learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analysis.

Course Outcomes

After successful completion of course the student should be able to

CO1. Apply and understand the basic concepts of Finite element analysis procedure.
CO2. Knowledge of mathematics and engineering in solving the problems related to structural and heat transfer.
CO3. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements
CO4. Develop element characteristic equation and generation of global equation.
CO5. Use the commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life structural problems.

UNIT I

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

One-Dimensional Elements: Bar, trusses, beams and frames, displacements, stresses and temperatureeffects.

UNIT III

Two Dimensional Problems: CST, LST, four noded and eight noded rectangular elements, Lagrangebasis for triangles and rectangles, serendipity interpolation functions. Aisymmetric Problems: Aisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, eamples: - two dimensional fin.

UNIT IV

IsoParametric Formulation: Concepts, sub parametric, super parametric elements, numericalintegration, Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, Pascal‟s triangle, Patch test.

UNIT V

Finite Elements in Structural Analysis: Static and dynamic analysis, Eigen value problems, and their solution methods, case studies using commercial finite element packages.

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

Text Books

1. Chandrupatla- Ashok and Belegundu,"Introduction to Finite Elements in Engineering", Prentice - Hall.
2. J N Reddy,"Finite Element Analysis", TMH

Reference Books

1. S. Md. Jalaludeen,"Introduction to Finite element analysis", Anuradha Publications
2. Krishna Murthy, "Learning Finite Element Method", TMH.
3. Bathe ,"Finite Element Analysis" , PHI.
4. SS Rao, "The Finite Element Methods in Engineering" ,Pergamon.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			H	M	L		L	M	M
CO2			L	M	H	M	L	H	L	L
CO3	M		M	H	L	H	L		H	
CO4	M			L	M	M		M	L	M
CO5			L	H	H	L	H	M	L	H

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET05: OPTIMIZATION TECHNIQUES FOR DESIGN

Credits – 3 | **Sessional Marks: 30**
L:T:P :: 3:0:0 | **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Many real-world problems require advanced techniques to formulate and to solve, and sometimes new optimization algorithms and procedures need to be designed.
2. A deeper understanding of the key concepts, theory, and algorithms of optimization, multi-objective optimization,
3. Know the More advanced modeling techniques in optimization.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the basic theory and some advanced topics in linear optimization.
CO2. Know the Constrained optimization Techniques and Non-traditional optimization Techniques
CO3. Identify the proper optimization technique(s) to attempt when problems are too large or too Complicated to solve in a straight forward way.
CO4. Use optimization software and implement solution algorithms involving large scale optimization Techniques.
CO5. Handle large data sets that accompany real-world optimization problems.

UNIT I

Introduction To Optimum Design: General principle of optimization – problem formulation & their classifications – formulations of variable – properties & optimality criteria, Region elimination methods - Bonding Phase, Interval refinement using interval halfing& golden section methods, Quadratic estimation methods, Method requiring derivaties-Newton Raphson, Bisection and secant methods.

UNIT II

Function Of Several Variables: Optimality criteria, Direct search methods -- Simple search, Hooke – Jeeves pattern search, powells conjugate Direction method , Gardient based methods – Cauchy, Newton , Marquardt method, Quasi Newton- Davidon Fletcher – Powell method.

UNIT III

Constrained optimization Techniques: Equality constrained problem, Lagrangian multiplier, Kuhn – Tucker conditions, Penalty function methods, Quadratic programming.

UNIT IV

Non-traditional optimization Techniques: Gentic Algorithms working principle, Reproduction Mutation , Crossover , termination, GA for constrained optimization, Simulated Annealing, Tabu Search and PSO Algorithms.

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

UNIT V

Multi Objective optimization: Principles, Non conflicting objectives, global criteria monc problem, Dominance and pareto optimality – procedure for finding a non – dominated set, non dominated sorting of a population – classical method, weighted sum and epsilon – constraints method, Goal programming methods – weight goals, leico graphic and minima goal programming.

Applications of Optimization in design and Manufacturing Systems: Optimization of path synthesis of a four – bar mechanism, minimization of weight of cantilever beam and general optimization model of a machine process.

Text Books

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

References Books

1. D.E. Goldberg, "Genetic algorithms in Search, Optimization, and Machine learning" –Addison-Wesley Publishers.
2. KalyanmoyDeb, "Multi objective optimization using evolutionary algorithms", Wiley International (2014).
3. Kalyanmoy Deb, "Multi objective Genetic algorithms", PHI Publishers.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			M	M	H		L	M	L
CO2			L	H		M	M		H	M
CO3	H		L	H	H		L	M		
CO4	M		M	M	M		H		M	L
CO5	M		L		L	L		H	L	M

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET06: EXPERIMENTAL STRESS ANALYSIS

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Use the method of electrical strain gauges to study and characterize the elastic behavior of solid bodies.
2. Measure displacement and perform stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. Describe the photo elastic method to study and characterize the elastic behavior of solid bodies.
4. Determine stress strain behavior of solid bodies using methods of coating
5. Conduct stress strain analysis of solid bodies using the methods Holography

Course Outcomes

CO1. After successful completion of course the student should be able to
CO2. Explain characterize the elastic behavior of solid bodies.
CO3. Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.
CO4. Know the skills for experimental investigations an accompanying laboratory course is desirable.
CO5. Discuss experimental investigations by predictions for other methods.
CO6. Describe various coating techniques.

UNIT I

Introduction: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions.Problems using plane stress and plane strain conditions, stress functions, Mohrs circle for stress strain, three dimensional stress strain relations.

UNIT II

Strain Measurement and Recordings: Various types of strain gauges, Electrical Resistance straingauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT III

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

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

UNIT IV

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

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach toMoire-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, eperimental procedure and techniques.

UNIT V

Bi-refringent 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.

Text Books

1. Dally and Riley, "Experimental Stress Analysis", McGraw Hill.
2. Sadhu Singh, "Experimental Stress Analysis",Khanna publisher.
3. Srinath L.S TaTa, "Experimental stress Analysis", McGraw Hill.

Reference Books

1. John Wiley & sons, "PhotoelasticityVol I and Vol II ", M.M.Frocht.
2. Kuske, Albrecht & Robertson John Wiley & Sons, "Photo Elastic Stress Analysis".
3. Holman, "Experimental Methods for Engineers", Tata McGraw-Hill Companies, 7th Edition, New York, 2007.
4. B. C. Nakra and K. K. Chaudhry, "Instrumentation, Measurement and Analysis", Tata McGraw-Hill Companies, Inc, New York, 7th Edition, 2006.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			H	M			L	M	L
CO2	H		L	H	L	M	M	L	L	
CO3	M			M		L	L		M	L
CO4	M		L	L	M	M	M	M	L	M
CO5			L	H	H	L	H	H	L	L
CO6	H			H	M			L	M	L

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET11: NON-DESTRUCTIVE TESTING AND FAILURE ANALYSIS

Credits – 3 **Sessional Marks: 30**
L:T:P : 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. The students are to be exposed to the concepts of various NDE techniques using radiography, ultrasonic's, liquid penetrates, magnetic patches and Eddy currents.
2. They will learn basic principles of these methods and will be able to select a testing process.
3. They will understand the advantages and disadvantages of these techniques.

Course Outcomes

After successful completion of course the student should be able to

CO1. Identify the requirements of testing criteria as per material composition
CO2. Understand the theory of non destructive testing methods is used
CO3. Determine the type of requirement of non destructive test
CO4. Understand the properties of radiation used in engineering.

UNIT I

Visual Examination: Liquid penetrate testing, magnetic particle testing, electromagnetic radiation in film, radiographic imaging, inspection techniques, applications, limitations, real time radiography, safety in industrial radiography.

UNIT II

Eddy Current Testing: Sensitivity application, limitation; ultrasonic testing – basic properties of sound beam, ultrasonic transducers; acoustic emission testing – principles of AET and techniques.

UNIT III

Comparison And Selection Of NDT Methods: Detection of defects, selection of NDT methods- VE, LPT, MPT, ECT, RT, UT, AET and thermography, selection of instrumentation for various NDT methods, Reliability in NDT.

UNIT IV

Failure Analysis: Methodology; approaches, tools and techniques of failure analysis, modes of failure, failure data retrieval; procedural steps for investigation of a failure for failure analysis.

UNIT V

Improvements (Design, Material): Derived from failure analysis, two case studies,application of fracture mechanics concepts to design for safety.

Text Books

1. Baldev Raj, Jayakumar T., Thavasimuthu .M., "Practical Non-Destructive Testing", Naros Publishing, 1997.
2. Das A.K., "Metallurgy of Failure Analysis", TMH, 1992.

Reference Books

1. E. A. Gingel, Prometheus Press, “Ultrasonic inspection training for NDT”.
2. ASTM Standards, “Metals and alloys”, Vol 3.01.
3. R. Hamchand, “Non-destructive Hand Book”.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M			H			H		
CO2	H		M	M				M	H	
CO3	L	H				M		H	L	M
CO4	H	M	L	L				L	M	

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET12: DESIGN FOR MANUFACTURABILITY

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives
To expose the students to the following
1. Develop the concepts of design for Manufacturing.
2. Learn about different concepts of Concurrent Engineering.
3. Design strategy for product development through brainstorming

Course Outcomes
After successful completion of course the student should be able to
CO1. Understand the concepts of Design for manufacturing.
CO2. Gain the knowledge about planning, resource availability and vendor partnership
CO3. Follow design strategy for product development.
CO4. Minimizing the cost by overall cost analysis in plants
CO5. Understand the DFM guidelines for part design, product design and quality for reliability.

UNIT I
Design for Manufacturability: Manufacturing before DFM, Myths and Realities ofProduct Development, Achieving the Lowest Cost, Designing for Low Cost, Cutting Time-to-Market in Half, Roles and Focus, Resistance to DFM, Arbitrary Decisions, DFM and Design Time, Engineering Change Orders, Do It Right the First Time, Strategy to Do It right the First Time, Company Benefits of DFM, Personal Benefits of DFM, Conclusions.

UNIT II
Concurrent Engineering: Resources, ensuring resource availability, product portfolioplanning, Parallel and future Projects, Designing Products as team, vendor partnerships, the team leader, co-location, team membership and roles, outsourcing engineering, product definition .

UNIT III
Designing the Product: Design strategy, importance of through up-front work, optimizing architecture and system design, part design strategies, design for everything (DFX), creative product development, brainstorming , half-cost product development.

UNIT IV
Minimizing Total Cost By Design: How not to lower cost, cost measurements,strategy to cut total cost in half, minimizing -cost through design, overhead costs, product development expenses, cost savings of off-the-shelf parts, engineering change order costs, cost of quality, rational selection of lowest cost supplier, low bidding,minimizing customization/configuration costs, minimizing the cost of variety, materials management costs, marketing costs, sales/Distribution costs, supply chain costs, life cycle costs, saving cost with built-to-order, effect of counterproductive cost reduction. maximizing- factory efficiency, lowering overhead costs with flexibility, Total cost: Value of total cost, quantifying overhead cost, resistance to total cost accounting, total cost thinking, implementing total cost accounting, cost drivers, tracking product development expenses, "ABC": the low- hanging –fruit approach, implementation efforts, typical results of total cost implementations.

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

UNIT V

DFM Guidelines for Product Design: Design for assembly, assembly designguidelines, fastening guidelines, assembly motion guide lines, test stragedy and guide lines, testing in quality versusbuilding in quality, design for repair and maintenance, repair design guidelines, design for service and repair, maintenance, maintenance measurements, designing for maintenance guidelines.

DFM Guidelines for Part Design: Part Design guidelines, DFM for fabricated parts,DFM for castings and molded parts, DFM for sheet metal, DFM for welding, DFM for large parts.

Design for Quality: Quality Design guidelines, tolerances, cumulative effects on productquality, reliability design guide lines, measurement of reliability, reliability phases, poka-yoke(mistake-proofing),poka-yoke principles , strategy to design in quality, customer satisfaction.

Text Books

1. David M.Anderson, "Design for Manufacturability", CRC press, 2014.

Reference Books

1. John cobert, Adisson Wesley, "Design for manufacture", CRC press (Pearson Education) 1995.
2. Boothroyd. Peter DewherstWinstan Knight, "Design for Manufacture", 2ndEducation.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M			H	L			L	M	
CO2	L		L	H	M	M	L	L	M	M
CO3			M	L		H	H	M	L	M
CO4	M		L	L	M	H	L	H	M	L
CO5			L	M	H	L	M	M	L	L

Dr. P.Snehalatha   Prof. B. Bala Krishna   Prof. A.RamaKrishna Rao
Co-ordinator (ME)   BoS Chairman (ME)   Director
SE&T   SE&T

19MMET13: PRESSURE VESSEL DESIGN

Credits – 3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Understand the basic knowledge of the pressure vessels.
2. Design of pressure vessels based on the load and stresses.
3. Design of pressure vessel based on discontinuity stresses.
4. Find the using of pressure vessel material and requirement environment.

Course Outcomes

After successful completion of course the student should be able to

CO1**.** Understand the basic vessels stresses and test.

CO2. Compute load and stress on rectangular and circular plate.

CO3. Compute Discontinuity stresses in pressure vessels.

CO4. Understand the pressure vessel materials and their environment.

CO5.Understand Design features.

UNIT I

Introduction: Materials-shapes of Vessels-stresses in cylindrical, spherical and arbitrary, shapedshells. Cylindrical Vessels subjected to internal pressure, wind load, bending and torque ilationof pressurevessels-conical and tetrahedral vessels.

Theory of Thick Cylinders: Shrink fit stresses in built upcylinders-auto frottage of thick cylinders, Thermal stresses in Pressure Vessels.

UNIT II

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

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 in a bimetallic joints, deformation and stresses in flanges.

UNIT IV

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

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.

Text Books

1. John F.Harvey, “Theory and design of modern Pressure Vessels”, Van nostrandreihold company, NewYork.
2. Bickell, M.B.Ruizcs, “Pressure Vessel Design and Analysis”.

Reference Books

1. Beowll&YoundEtt , “Process Equipment design”.
2.Indian standard code for unfired, “Pressure vessels IS:2825”.
3. Henry H.Bednar, P.E., “Pressure Vessel Design Hand Book”, C.B.S.Publishers, New Delhi.
4. Timoshenko &Noinosky, “Theory of plates and shells” .

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M			L			H	M	H	
CO2	H	M	L				M	H		M
CO3	M		L	H			L	H	M	
CO4	L	M	L				H		H	L
CO5		M	L	H			M	M		H

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET14: COMPUTATIONAL FLUID DYNAMICS

Credits – 3 | **Sessional Marks: 30**
L: T: P:: 3:0:0 | **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the different finite methods with boundary conditions.
2. Know the Parabolic and Hyperbolic Equations by using Explicit & Implicit Methods. Also Compressible &Incompressible Flows with different methods.
3. Understand the Finite difference and volume methods in two dimensional as well as three dimensional and standard variational methods.

Course Outcomes

After successful completion of course the student should be able to

CO1. Study the different finite methods and applying the boundary conditions for problem solving.
CO2. Analyze the problems in simplification manner by using Implicit and Explicit Methods.
CO3. Design the compressible and incompressible flows into various methods in CFD.
CO4. Design and analyze the problems in two dimensional and three dimensional structures in FVM.
CO5. Design and solve the problems in linear fluid flow both in steady & transient states it helps to apply the professionally.

UNIT I

Introduction: Finite difference method, finite volume method, finite element method, governing equations andboundary conditions, Derivation of finite difference equations.
Solution methods: Solution methods of elliptical equations – finite difference formulations, interactive solutionmethods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumannstability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional stepmethods, direct method with tridiagonal matrix algorithm.

UNIT II

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi-stepmethods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit andimplicit schemes, Runge-Kutta method.

UNIT III

Formulations of incompressible viscous flows: Formulations of incompressible viscous flows by finite differencemethods, pressure correction methods, vortex methods.
Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flowfield-dependent variation methods, boundary conditions, example problems.

UNIT IV

Finite volume method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT V

Standard variational methods: Linear fluid flow problems, steady state problems, Transient problems.

Text Book

1. Computational fluid dynamics, T. J. Chung, Cambridge University press, 2002.

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

Reference Book

1. Text book of fluid dynamics, Frank Chorlton, CBS Publishers & distributors, 1985.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H								H	
CO2	H					M			H	
CO3				M			H	M	H	
CO4	L			M			H		H	M
CO5	L			M			H		H	M

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET19: PRODUCT DESIGN

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives
To expose the students to the following
1. Understand the concept of the Product design and simulation.
2. Learn the concepts and procedures of design for reliability, maintainability and availability with product and user safety.
3. Analyze the different process of product management through innovation and effective relationship of the products.

Course Outcomes
After successful completion of course the student should be able to
CO1. Explain concept of the product design process, modeling and simulation.
CO2. Analyze the different process of product management through innovation and effective relationship.
CO3. Analyze the failures, risk management and reliability of the different products.
CO4. Test and validate the effectiveness of a products.
CO5. Learn the concepts and procedures of design for reliability, maintainability and availability with product and user safety.

UNIT I

Product Design Process: Design Process Steps, Morphology of Design, Problem Solving and Decision Making: Problem-Solving Process, Creative Problem Solving, Invention, Brainstorming, Morphological Analysis, Behavioral Aspects of Decision Making, Decision Theory, Decision Matrix, Decision Trees.
Modeling and Simulation: Triz, Role of Models in Engineering Design, Mathematical Modeling, Similitude and Scale Models, Computer Simulation, Geometric Modeling on Computer, Finite-Element Analysis.

UNIT II

Product management: The operation of product management: Customer focus of product management, product planning process, Levels of strategic planning, Wedge analysis, Opportunity search, Product life cycle, Life cycle theory and practice. Product development: Managing new products, Generating ideas, Sources of product innovation, selecting the best ideas, the political dimension of product design, Managing the product launch and customer feedback. Product managers and manufacturing: The need for effective relationships, The impact of manufacturing processes on product decisions, Prototype planning, Productivity potentials, Management of product quality, Customer service levels.

UNIT III

Risk and Reliability: Risk and Society, Hazard Analysis, Fault Tree Analysis. Failure Analysis and Quality: Causes of Failures, Failure Modes, Failure Mode and Effect Analysis, FMEA Procedure, Classification of Severity, Computation of Criticality Index, Determination of Corrective Action, Sources of Information, Copyright and Copying, Patent Literature.

UNIT IV

Product testing: thermal, vibration, electrical, and combined environments, temperature testing, vibration testing, test effectiveness. Accelerated testing and data analysis, accelerated factors. Weibull probability plotting, testing with censored data.

UNIT V

Design For Maintainability: Maintenance Concepts and Procedures, Component Reliability, Maintainability and Availability, Fault Isolation in design and Self-Diagnostics. Product Design for Safety, Product Safety and User Safety Concepts, Examples of Safe Designs.

Design Standardization and Cost Reduction: Standardization Methodology, Benefits of Product Standardization; International, National, Association and Company Level Standards; Parts, Modularization.

Text Books

1. George E. Dieter, "Engineering Design", McGraw-Hill.
2. John W. Evans and Jillian Y. Evans, "Product Integrity and Reliability in Design", Springer Verlag.

Reference Books

1. Richard S. Handscombe, "The Product Management Handbook", McGraw-Hill.
2. Ulrich Eppinger, "New Product Design".
3. Kevin Otto, "Product Design".

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M				H			H		
CO2		M		M					M	
CO3	M		M							M
CO4		M			M		H			M
CO5	M	L					M		L	

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET20: MECHANICS OF COMPOSITE MATERIALS

Credits – 3	**Sessional Marks: 30**
L:T:P :: 3:0:0	**University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Analyze the different processing/ fabrication techniques of composite materials especially fiber components
2. Brief descriptions for the polymer materials and its applications which are having better improved properties to suit with conventional materials.
3. Understand the Failure Analysis of different Composites and Design of Laminates
4. Analyze the Macromechanical Analysis of Laminates.

Course Outcomes

After successful completion of course the student should be able to

CO1. Explain concept of the composite materials and its terminologies used.

CO2. Analyze the different processing/ fabrication techniques of composite materials especially fiber components

CO3. Describe the polymer materials and its applications which are having better improved properties to suit with conventional materials

CO4. Analyze the fiber and matrix properties for structural applications.

CO5. Analyze the design parameters of laminates.

UNITI

Introduction to Composites: Introduction, Classification, matrix materials, reinforced matrix of composites

UNIT-II

Hooke's Law for a Two-Dimensional: Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Failure Theories of an Angle Lamina : Maximum Stress Failure Theory Strength Ratio,FailureEnvelopes,Maximum Strain Failure Theory ,Tsai–Hill Failure Theory, Tsai–Wu Failure Theory, Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an Angle Lamina.

UNIT III

Macro mechanical Analysis of a Lamina: Introduction ,Definitions: Stress, Strain ,Elastic Moduli,Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

Dr. P.Snehalatha	Prof. B. Bala Krishna	Prof. A.RamaKrishna Rao	
Co-ordinator (ME)	BoS Chairman (ME)		Director
SE&T	SE&T		

UNIT IV

Micromechanical Analysis of a Lamina : Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi-Empirical Models, Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion.

Macromechanical Analysis of Laminates: Introduction ,LaminateCode , Stress–Strain Relations for a Laminate, In-Plane and FlexuralModulus of a Laminate ,Hygrothermal Effects in a Laminate, Warpage of Laminates,hybrid laminates.

UNIT V

Failure, Analysis, and Design of Laminates: Introduction, Special Cases of Laminates, FailureCriterion for a Laminate, Design of a Laminated Composite, static analysis of laminated plates.

Text Books

1. Isaac and M Daniel, "Engineering Mechanics of Composite Materials", by Oxford University Press, 1994.
2. B. D. Agarwal and L. J. Broutman, "Analysis and performance of fibre Composites", Wiley-Interscience, New York, 1980.

ReferencesBooks

1. R. M. Jones, "Mechanics of Composite Materials", McGraw Hill Company, New York, 1975.
2. L. R. Calcote, "Analysis of Laminated Composite Structures", Van NostrandRainfold, New York, 1969.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M			H	L			L	M	L
CO2	H		L		M	H		L	H	
CO3	M		M	H		M	M	H	M	
CO4	M			L	M	M	H	M	L	H
CO5			L	M	H	H	L	H	M	L

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMET21:GEAR ENGINEERING

Credits – 3 | **Sessional Marks: 30**
L:T:P::3:0:0 | **University Exam Marks: 70**

Course Objectives

To expose the students to the following
1. Understand the basic gear tooth processes and inspection.
2. Design of gear processes.
3. Design of gear trains and failure.
4. Design of Optimal gear.

Course Outcomes

After successful completion of course the student should be able to
CO1:Analyze the Gear tooth manufacturing processes and stresses.
CO2:Understand the Geometry, Design considerations and methodology.
CO3:Design of gear train system.
CO4:Gear failure criteria.

UNITI

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.

UNIT II

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

UNIT III

Gear trains: Simple, compound and epicyclic gear trains, Ray diagrams, Design of a gear box ofan automobile, Design of gear trains from the propeller shafts of airplanes for auxiliary systems.

UNIT IV

Gear failures: Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth breakage,pitting, scoring, wear, overloading, gear-casing problems, lubrication failures.

UNITV

Optimal Gear design: Optimization of gear design parameters, Weight minimization,Constraints in gear train design-space, interference, strength, dynamic considerations, rigidityetc. Compact design of gear trains, multi objective optimization of gear trains. Application ofTraditional and non-traditional optimization techniques

Text Books

1. Maleev and Hartman, "Machine Design", 3rd Edition C.B.S. Publishers, India.
2. Henry E.Merrit ,"Gear engineering" , Wheeler publishing,Allahabad,1992.
3. Darle W. Dudley, "Practical Gear design", McGraw-Hill book company

Reference Books

1. Earle Buckingham, "Analytical mechanics of gears", Dover publications, New York, 1949.

Dr. P.Snehalatha	Prof. B. Bala Krishna	Prof. A.RamaKrishna Rao
Co-ordinator (ME) SE&T	BoS Chairman (ME) SE&T	Director

2. G.M.Maitha, “Hand book of gear design”, Tata Mc.Graw Hill publishing company Ltd., New Delhi, 1994.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M		H	L			L	H		M
CO2	M	M	L	H					H	M
CO3	M		L	H			M	M	H	
CO4	L	M	L				H	M		H

19MMET22: ADVANCED OPERATIONS RESEARCH

Credits – 3 | **Sessional Marks: 30**
L:T:P::3:0:0 | **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Explain the characteristics of OR and obtain a solution to an LP problem.
2. Obtain a dual of the given LP problem and solve special types of LP problems like Transportation Problem.
3. Solve Assignment and Travelling salesman problem by using Hungarian algorithm.

Course Outcomes

After successful completion of course the student should be able to

CO1. Obtain a solution to an LP problem by Simplex algorithm and Big M method.
CO2. Write down the dual of a given LP problem and solve a Transportation problem using Stepping stone method and MODI method.
CO3. Obtain a solution to Assignment and Travelling salesman problems using Hungarian algorithm
CO4. Obtain a solution to (m x n) sequencing problems using Johnson's algorithm and CDS heuristic and SolveRectangular games using dominance principle and graphical method.
CO5. Determine the critical path of a network using CPM and PERT.

UNIT I

Integer Programming: Introduction, types of Integer Programming Problems, Branch and bound algorithm, Enumeration and Cutting plane methods for pure and mixed Integer programming problems, Gomory's All Integer Cutting Plane Method,Gomory's Mixed Integer Cutting Plane Method, Applications of Zero-one Integer Programming, Knap-sack, travelling salesman and shortest route problems.

UNIT II

Non-linear Programming: Introduction, the general Non-Linear Programming Problem, Constraint qualification and Kuhn-Tucker necessary conditions. Sufficiency of Kuhn-Tucker necessary conditions and convex programs, Linear Complementarity Problem (LCP) and Lemke's complementary pivot algorithm, Copositive plus matrices and Lemke's algorithm, Quadratic programming and use of LCP for solving quadratic programming problems, Separable Programming. Linear fractional Programming, Geometric Programming, Stochastic Programming.

UNIT III

Dynamic Programming: Introduction, Dynamic Programming Terminology, Developing Optimal Decision Policy, Dynamic Programming under Certainty, Dynamic Programming Approach for Solving Linear Programming Problems, Bellman's principle of optimality and recursive relationship of dynamic programming for various optimization problems.

UNIT IV

Goal Programming: Introduction, Difference between L.P and G.P approach, Concept of Goal Programming, Goal Programming model formulation, Graphical solution method for Goal Programming, Modified Simple method of Goal Programming, Alternative Simplex Method for Goal Programming.

UNIT V

Replacement and Maintenance Models: Introduction, Types of failure, Replacement of items whose efficiency deteriorates with time, Replacement of items that completely fail, Mortality and staffing problems, Miscellaneous Replacement problems.

Dr. P.Snehalatha / Co-ordinator (ME) / SE&T

Prof. B. Bala Krishna / Prof. A.RamaKrishna Rao / BoS Chairman (ME) / SE&T

Director

Text Books

1. Non Linear Programming: Theory and Algorithms - M.S. Bazara and C.M. Shetty, John Wiley.
2. Non-linear Programming- W.I. Zangwill, Prentice Hall.
3. Operations Research: Theory and Applications- J K Sharma,Macmillan.

Reference Books

1. Practical Methods of constrained optimization - R. Fletcher, John Wiley.
2. The Art and Theory of Dynamic Programming - S.E. Dreyfus, Academic Press.
3. Applied Dynamic Programming - R. Bellman and S. Dreyfus, Princeton, N.J.

4 Integer Programming - R.S. Garfinkel and G.L. Nemhauser, John Wiley.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1			M			M				
CO2	M			H						M
CO3		M	M						H	
CO4	M						M			M
CO5		M		L						

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMEJ01: PROJECT WORK PHASE – I

Credits – 10 **Sessional Marks: 40**
L:T:P::0:0:20 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Offer students a glimpse into real world problems and challenges that needs Mechanical Engineering.
2. Provide students with the opportunity to synthesize knowledge in the area of Mechanical Engineering.
3. Introduce students to the vast array of literature available of the various research challenges in the field of Mechanical Engineering.
4. Create awareness among the students of the characteristics of several domain areas where Mechanical Engineering can be effectively used.
5. Enhance students knowledge and enables them to acquire skills like collaboration, communication and independent learning, prepares them for lifelong learning and the challengers a head.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.
CO2. Critically analyze the chosen topic for arriving at conclusions.
CO3. Develop and design feasible solutions for the project topic.
CO4. Undertake research and solve real world problems in the project domain.
CO5. Apply appropriate techniques, resources and modern software tools necessary for implementing the project work.
CO6. Use project results for sustainable development of the society.
CO7. Understand the impact of project results in the context of environmental sustainability.
CO8. Understand professional and ethical responsibilities for sustainable development of society in the chosen field of project.
CO9. Function effectively as individual and a member in the project team.
CO10. Develop communication skills, both oral and written for preparing and presenting project report.
CO11. Demonstrate knowledge and understanding of cost and time analysis required for carrying outthe project.
CO12. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T

19MMEJ02: PROJECT WORK PHASE – II

Credits – 16 **Sessional Marks: 40**
L:T:P:: 0:0:32 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Offer student's a glimpse into real world problems and challenges that need in the field of Mechanical Engineering.
2. Provide students with the opportunity to synthesize knowledge in the area of Mechanical Engineering.
3. Introduce students to the vast array of literature available of the various research challenges in the field of Mechanical Engineering.
4. Create awareness among the students of the characteristics of several domain areas where Mechanical Engineering can be effectively used.
5. Enhance student's knowledge and enables them to acquire skills like collaboration, Communication and independent learning, prepares them for lifelong learning and the challenges ahead.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.

CO2. Critically analyze the chosen topic for arriving at conclusions.

CO3. Develop and design feasible solutions for the project topic.

CO4. Undertake research and solve real world problems in the project domain.

CO5. Apply appropriate techniques, resources and modern software tools necessary for implementing the Project work.

CO6. Use project results for sustainable development of the society.

CO7. Understand the impact of project results in the context of environmental sustainability.

CO8. Understand professional and ethical responsibilities for sustainable development of society in the chosen field of project.

CO9. Function effectively as individual and a member in the project team.

CO10. Develop communication skills, both oral and written for preparing and presenting project report.

CO11. Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.

CO12. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.

Dr. P.Snehalatha	Prof. B. Bala Krishna Prof. A.RamaKrishna Rao	
Co-ordinator (ME)	BoS Chairman (ME)	Director
SE&T	SE&T	

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		M									H	M	
CO2		H	M		M								M	H	
CO3		M	H		M								H	M	
CO4				H		M				M				M	H
CO5			M		H					M				H	
CO6						H	M								H
CO7						M	H								H
CO8							M	H							M
CO9									H	M	M				M
CO10								M		H	M				H
CO11									M		H				H
CO12	M	M										H			H

Dr. P.Snehalatha Prof. B. Bala Krishna Prof. A.RamaKrishna Rao
Co-ordinator (ME) BoS Chairman (ME) Director
SE&T SE&T