Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

M. Tech. (Machine Design)

Semester-I

(Effective from the session: 2022-23)

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

Two Years M.Tech. Programmme
Scheme of Teaching and Examination
M.Tech. First Semester Machine Design
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the session: 2022-23)

S.N	Course Code	Course Title	Hours per week			Credit	Examination Scheme			Sem End Exam Duration (Hrs)
			L	T	P		Continuous Evaluation	Sem End Exam	Total	
1.	MSCCP101T	Stress and Deformation analysis	3	1	-	4	30	70	100	3
2.	MENDE102T	Tribology	3	1	-	4	30	70	100	3
3.	MENDE101 P	Tribology Lab	-	-	4	2	15	35	50	-
4.	MENDE103T	Composite Materials	3	1	-	4	30	70	100	3
5.	MENDE104T	Theory of Elasticity & Plasticity	3	1	-	4	30	70	100	3
6.	MENDE105T	Elective - I	3	1	-	4	30	70	100	3
7.	MENDE102 P	Composite Materials Lab	-	-	4	2	15	35	50	-
						24			600	

L – LECTURE, T- TUTORIAL, P- PRACTICAL, EX-EXAM, IN- INTERNAL, TC- TOTAL CREDIT, Th- THOERY, Pr- PRACTICAL

List of Electives-I

S.No.	Subject	Subject Code
I	Advanced Finite Element Method	
II	Analysis & Design of Pressure Vessels & Components	
III	Mechanical Vibration	

Course Title	**ADVANCED COMPUTATIONAL METHODOLOGY**				
Course Code	**MSCCP101T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**ENGINEERING MATHEMATICS –I, II & III**				
Course objectives	**This course will enable students to:** • To represent the problems mathematically. • To optimize the solutions. • To analyze the result numerically and linguistically by fuzzy theory. • Emphasize the meaning and purpose of these techniques and their use in solving Engineering Problems.				
Course Contents	**UNIT – I** **Graph Theory And Its Application** Basic Terminology. Simple graph. Multi graph, Types of graph .Path .Cycles. Eulerian and Hamiltonian graph. Shortest path problem Representation of graph. Trees and their properties. Spanning Tree. Binary Tree. Tree traversal. **UNIT - II** **Fuzzy Set And Its Applications** Fuzzy sets-Basic definitions, α-level sets. Convex fuzzy sets. Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian products, Algebraic products. Bounded sum and difference, t-norms and t-conorms. The Extension Principle- The Zadeh's extension principle. Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic. **UNIT – III** **Cryptography And Its Application** Introduction to the Concepts of Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques:				

	Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks. DES, RSA, Digital Signature. **UNIT - IV** **Statistical Analysis** Expectation and variance of random variable. Sampling Distribution. Testing a Hypothesis. Level of significance. Confidence limits. Test of significance for large sample. Central limit theorem. Test of significance for means of two large samples. Sampling Variables-small samples. Student t-distribution, Chi-square test. **UNIT - V** **Optimization Techniques** Dynamic Programming-Deterministic and Probabilistic Dynamic programming. Inventory- Basic characteristics of an inventory system. The Economic order quantity. Deterministic models. Network analysis (PERT/ CPM).
Course outcomes	**After the completion of course:** 1. This is the foundation of research and development in the computational domain of engineering and technology. 2. As the prerequisite, this will be traced the thought and ideas to design the behavioral tools over the engineering range. 3. This is a transformation from theory to application through measuring theory of natural problems and its applications.
Text Books	1. Calculus of Variations with Applications, Gupta, A.S. Prentice Hall of India(P) Ltd., N e w Delhi, 6th print, 2006 2. Introduction to Partial Differential Equations, Sankar Rao, .K Prentice Hall of India(P) Ltd., New Delhi, 5th print, 2004 3. Advanced Engineering Mathematics, Jain.R.K, Iyengar.S.R.K. Narosa publications 2nd Edition,2006 4. Numerical Methods in Science and Engineering, Grewal, B.S - Kanna

	Publications, New Delhi. 5. Numerical Methods, Kandasamy.P , Thilagavathy. K and Gunavathy, S Chand and Co., Ltd., New Delhi, 5th Edition, 2007 6. Theory and problems of Complex Variables with an Introduction to Conformal Mapping and Its applications, Schaum's outline series, Spiegel, M. R - Mc Graw Hill Book Co., 1987.
Reference Books	1. Multi - Objective Optimization Using Evolutionary Algorithms, K. Deb(2003)John Wiley 2. Applied Statistics & Probability for Engineers: Montgomery, Douglas C. & Runger, George C. (2007), 3/e,Wiley India. 3. Parallel distributed processing Vol.1 (1986) Rumelhart, D.E and McClelland, J.L.,, M I T Press, 1986. 4. Fuzzy logic implementation and applications (1996), Patyra, M.J. and Mlynek Wiley,

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Course Title	**TRIBOLOGY**				
Course Code	**MENDE102T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**ENGINEERING MATHEMATICS –I, II & III**				
Course objectives	**This course will enable students to:** • Differentiate between the types of lubricants and its respective application area. • Understand and explain different laws of friction and topology of surfaces. • Appreciate the various modes of wear and the wear-mechanism maps				
Course Contents	**UNIT – I** Introduction of Tribology, Contact of solids, Nature of Surface interaction, Types of friction, Theory of friction, Mechanism of Rolling friction, Friction instabilities. Wear and its mechanism, types of wear, Factor affecting wear, control of wear, wear test rig. **UNIT - II** Lubricants: Properties, selection, Regime of lubrication, Lubricant test, solid lubricant Theory of Hydrodynamic lubrication, Reynolds Equation, Infinitely Long bearing , Infinitely short bearing. Unit-3 Converging- diverging wedge, Summerfield Condition, Reynolds Condition, Center of pressure, Exponential film. Plane slider bearing, Raleigh step bearing. Unit-4 Hydrodynamic Journal Bearing, Pressure equation, short bearing, Summerfield method for infinitely long bearings, viscous friction, Petrify 's Equation, cooling of bearing. Porous Bearing. Unit-5				

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	Hydrostatic lubrication, Foot step Bearing Hydrostatic Lift. Elastohydrodynamic Lubrication, squeeze Film lubrication, rolling contact bearing.
Course outcomes	**After the completion of course:** 4. Understand behaviour of bearing in different lubrication regimes and able to develop mathematical model. 5. Select the type of bearing for any given required engineering use and determine the load carrying capacity and other related parameters. 6. Decide on the condition monitoring techniques based on performance of tribological components.
Text Books	7. Engineering Tribology– Prasanta Sahoo – Prentice Hall of India Pvt. Ltd., New Delhi, 2005. 8. Fundamentals of Tribology – S.K. Basu, S.N. Sengupta, B.B. Ahuja – PHI Learning Pvt. Ltd., 2010. 9. Tribology in Industries – S.K. Shrivastava – S. Chand & Company Ltd., New Delhi, 2001 10. Bearing Design in Machinery, Engineering Tribology and Lubrication - A. Harnoy- Marcel Dekker Inc., 2003
Reference Books	**5. Engineering Tribology – G.W. Stachowiak, A.W. Batchelor – Elsevier India Pvt. Ltd., New Delhi.** **6. Introduction to Tribology of Bearings – B.C. Majumdar – S. Chand & Company Ltd., New Delhi.** **7. Rolling Bearing Analysis – T.A. Harris – John Wiley & Sons, Inc., New York** **8. Engineering Tribology – J. Williams - Cambridge University Press, 2004.**

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Course Title	**COMPOSITE MATERIALS**				
Course Code	**MENDE103T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**ENGINEERING MATHEMATICS –I, II & III**				
Course objectives	**This course will enable students to:** • Distinguish and categorize the types of composite materials. • Apply the concepts of tensors and estimate the engineering constants of composite materials. • Identify and apply the concepts of plate theory in solving composite structural problems.				
Course Contents	**UNIT – I** Classification and characterization of composite materials; fibrous, laminated and particulate composites; laminar and laminates; manufacture of laminated fibre – reinforced composite materials. **UNIT - II** Micromechanical behavior of laminar; stress-strain relations, engineering constraints for orthotropic materials stress-strain relations for lamina of arbitrary orientation. Strength and stiffness of an orthotropic lamina; **UNIT - III** Bi-axial strength theories. Micromechanical behavior of laminate; Rule of mixtures; Micromechanical behavior of laminates **UNIT - VI** Single layered configurations, symmetric laminates, and anti-symmetric laminates, known symmetric laminates; Strength of laminates; Interlaminar stresses. **UNIT - V** Design of laminates. Buckling and vibration of laminated beams, plates and shells.				
Course outcomes	**After the completion of course:**				

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	7. Interpret the cause of failure of the composite structures. 8. Apply Micromechanics principles in estimating the properties of fibrous composites
Text Books	• **Composite materials: Design and application by Daniel Gay-et-al.**
Reference Books	• **Mechanics of composite materials By Richard M Christensen** • **Introduction to composite materials design (Material Science & Engg.Series) By Barbero** • **Composite Manufacturing Material, Product and Process Engg. By Sanjay Majumdar**

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Course Title	**THEORY OF ELASTICITY &PLASTICITY**				
Course Code	**MENDE104T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**ENGINEERING MATHEMATICS –I, II & III**				
Course objectives	**This course will enable students to:** • To represent the problems mathematically. • To optimize the solutions. • To analyze the result numerically and linguistically by fuzzy theory. • Emphasize the meaning and purpose of these techniques and their use in solving Engineering Problems.				
Course Contents	**UNIT – I** Unit-1 Theory of Elasticity: Plane stresses and plane strain problems, Equations of equilibrium, Equations of compatibility, Boundary conditions. Stresses functions, Bihamonic Equations. Unit-2 Two Dimensional Problems in Rectangular Coordinate: Saint Venants Principle, Solution by polymonials, Bending of Cantilever and simply supported beams. Unit-3 Problems in Polar Coordinates: Stress distribution symmetrical about an axis, Bending of curved beams, Thick cylinder Rotating Solid and hollow discs, Rotating shafts and cylinder, disc of uniform strength, Shrunk fit assemblies of cylinder, stress concentration due to circular hole in a plate subjected to tensile load. Unit-4 a) Bending of Plates: Rectangular Plate, Bending of axis – symmetric plate with different end conditions. b) Torsion of Non Circular shafts: Saint Venants theory of rectangular shafts, Equilateral triangular shaft, Elliptical shaft, Torsion of hollow cross sections, Membrane Analogy Unit-5 Theory of Plasticity: Introduction Saint Venants theory of plastic flow, yield criteria, plastic torsion of bars of circular cross section				

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Course outcomes	**After the completion of course:** 9. This is the foundation of research and development in the computational domain of engineering and technology. 10. As the prerequisite, this will be traced the thought and ideas to design the behavioral tools over the engineering range. 11. This is a transformation from theory to application through measuring theory.
Text Books	• **Theory of Elasticity – S.P.Timoshenko &J.N.Goodier** • **Theory of Elasticity - Dr.Sadhu Singh-Khanna Publishers** • **Theory of Plasticity - Dr.Sadhu Singh –Khanna Publishers**
Reference Books	• **Theory of Elasticity – S.P.Timoshenko &J.N.Goodier** • **Theory of Elasticity - Dr.Sadhu Singh-Khanna Publishers** • **Theory of Plasticity - Dr.Sadhu Singh –Khanna Publishers**

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Course Title	**Advanced Finite Element Method**				
Course Code	**MENDE105T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**ENGINEERING MATHEMATICS –I, II & III, SOM, FM, HMT**				
Course objectives	**This course will enable students to:** • Knowledge of the concepts, mathematical formulation and numerical implementation of FEM and knowledge. • FEM as applied to solid mechanics, fluid mechanics and heat transfer problems.				
Course Contents	**UNIT – I** 1: Introduction and Approximations Introduction to Finite Element Method, Discretization, Methods of weighted residual, Strong and weak forms for 1D and 2D problems, Energy principles. 09 2: Elements and their shape functions Global, local and natural coordinates, shape functions and their properties, Lagrange interpolation,				

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	one, two and three dimensional elements, Serendipity elements, h-p elements, isoparametric elements, Gauss-Legendre's quadrature. 09 3: Direct Formulation Principle of Minimum Potential Energy,Direct approach, element and assembly stiffness, treatment of boundary conditions, bar, truss, beam and frame elements. 09 4: Energy Principle based formulation Constitutive and compatibility relations, Finite element formulation for plane stress, plane strain and axisymmetric problem. Work equivalence, structural formulation using CST and isoparametric elements. 09 5: Scalar field problems and Dynamics One and two dimensional formulation of Scalar field problems,Application to inviscid and viscid flows, heat transfer, analogous problems of torsion. Hamilton's Principle, Lagrange's equation, lumped andconsistent mass matrices.
Course outcomes	**After the completion of course:** 1. The ability to invoke appropriate assumptions, select proper elements and develop and validate a Finite Element model using a range of techniques. 2. Application of complex problem solving techniques using Software/libraries in team and as individual as well in time effective manner and demonstrate inquisitiveness for further learning. 3. Be able to communicate effectively and truthfully in reporting (both textually and graphically) the method used, the implementation and the numerical results obtained.
Text Books	• **Textbook of Finite Element Analysis, P Sheshu, PHI, 2004.** • **Finite Element Methods for Engineers, U S Dixit, Cengage Learning, 2011.**
Reference Books	• **Concepts and Application of Finite Elements Analysis, Cook, Malkus and Plesha, Wiley.** • **An Introduction to Finite Element Method, J N Reddy, McGraw Hill International Edition.** • **Finite Element Procedures, K J Bathe.**