Mechanical Engg. Department

Teaching Scheme Semester : 4

Course Code	Course Name	Lecture hours	Tutorial hours	Practical hours	Credit
MA 2002	Mathematics IV: Introduction to Numerical Methods	3	1	0	4
ME 2001	Material Science and Engieering	3	1	2	5
ME 2003	Thermodynamics	3	1	0	4
ME 2004	Manufacturing Processes	2	1	3	4
ME 2005	Introduction to Design and Innovation	3	0	2	4
ME 2501	Lab Oriented Project/Study Oriented Project	0	0	3	2
	Total	**14**	**4**	**10**	**23**

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I	Course Code	**MA 2002**			
II	Course Title	**Mathematics IV: Introduction to Numerical Methods**			
III	Credit Structure	L	P	T	C
		3	0	1	4
IV	Prerequisite(If any for the student)	Nil			
V	Course Content	Introduction, Floating Point Arithmetic, Interpolation by polynomials, divided differences, error of interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical differentiation, Numerical quadrature (Trapezoidal, Simpson's and Gauss methods).Numerical Linear AlgebraSolution of a system of linear equations, Gauss elimination,Gauss Seidel methods, partial pivoting, LU factorization, Cholesky's method, matrixnorms. Eigen value problem, Gershgorin's theorem, Power and inverse power methods, QR method. Numerical solution of ordinary differential equations, Euler, Multistep, Runge-Kuttamethods. BVP finite difference methods. Introduction to finite element method and 1 D problem. Numerical solution to elliptic PDE. Introduction to statistics and probability. Random variable and probability function. Expectation of random variable.			
VI	Text/References	1. Elementary Numerical Analysis An Algorithmic Approach (3rd ed) by S.D. Conte and C. deBoor, McGraw Hill. 2. Introduction to Numerical Analysis (2nd ed) by C.E. Froberg, Addison-Wesley. 3. Advanced Engineering Mathematics by E. Kreyszig, Wiley India. Elementary Numerical Analysis by K. Atkinson and W. Han, Wiley India.			

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<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">ME 2001</td></tr>
<tr><td>II</td><td>Course Title</td><td colspan="4">Material Science & Engineering</td></tr>
<tr><td rowspan="2">III</td><td rowspan="2">Credit Structure</td><td>L</td><td>P</td><td>T</td><td>C</td></tr>
<tr><td>3</td><td>2</td><td>1</td><td>5</td></tr>
<tr><td>IV</td><td>Prerequisite(If any for the student)</td><td colspan="4">Nil</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">Introduction, Materials in Engineering design, the evolution of engineering materials, the families of engineering materials, modern materials, properties of engineering materials; Fundamentals, Atomic bonding, Crystalline structure-perfection/imperfection, phase diagrams, diffusion in solids, phase transformations; Structural materials and their behavior: Metals and alloys, ceramics and glasses, polymers, composites, conductors, semiconductors, optical and magnetic materials, mechanical and thermal behavior, electrical behavior, optical behavior, magnetic behavior; Corrosion and degradation of engineering materials; Material selection and design consideration: materials and industrial design, material property charts, material selection strategy and procedure, economic, environmental and societal issues related to engineering materials; case studies related to few engineering products/equipments.
Laboratory Experiments:
1. Tension test
2. Three point bending test
3. Compression test
4. Impact test
5. Hardness test
6. Microscopy
7. Group Project</td></tr>
<tr><td>VI</td><td>Text/References</td><td colspan="4">1. Mechanical Metallurgy by George E Dieter
2. Mechanical Behaviour and Testing of Materials by A K Bhargava and C P Sharma</td></tr>
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<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">ME 2003</td></tr>
<tr><td>II</td><td>Course Title</td><td colspan="4">Thermodynamics</td></tr>
<tr><td rowspan="2">III</td><td rowspan="2">Credit Structure</td><td>L</td><td>P</td><td>T</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td>IV</td><td>Prerequisite(If any for the student)</td><td colspan="4">Nil</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">Introductory Concepts and Definitions: Areas of Application of Thermodynamics, Different Approaches in the study of Thermodynamics, System, Surroundings, Types of Systems, Intensive and Extensive Properties, Thermodynamic equilibrium, Energy, Heat & Work. First Law of Thermodynamics: Path and point Function, Perpetual Motion Machine, Analysis of Closed Systems. Constant Pressure Process, Constant Volume Process, Specific Heat, Constant Temperature Process, Adiabatic Process. Characterisation of Reversible Adiabatic Process, Polytropic Process, First Law of Thermodynamics for a Continuous System, Steady-state Flow Processes, Application of Steady State Flow Processes, Throttling Process, Application of Throttling Process. Evaluating Properties of Pure Substances: Thermodynamic Properties of Fluids, Pure substance, Equations of State, Ideal Gas, The Van der Waals Constants, Virial Equation of State, Compressibility Chart, Phase-Change Process of Pure Substances, Steam Tables. Second Law of Thermodynamics, Entropy and Availability: Limitations of First Law of Thermodynamics, Heat Engine, Heat Pump, Refrigerator, KELVIN PLANCK STATEMENT, Clausius Statement of the Second Law .,Reversibility, Irreversibility and Carnot cycle, Carnot Engine, Carnot's Principles (Theorems), Reversible Cycles and Clausius Inequality: Substitution of a reversible process by the reversible isothermal and reversible adiabatic processes, Clausius Inequality, Entropy, Principle of Entropy Increase, calculation of entropy change. Temperature Entropy Diagram & Second Law Analysis of a Control Volume, TdS Equations, Entropy change of an incompressible substance, criterion of equilibrium, Thermodynamic definition of temperature, pressure and chemical potential, Thermodynamic potentials, Availability & Irreversibility, Availabilty Function and Irreversibility. Power and Refrigeration Cycles: Introduction, Practical Rankine Cycle, Reheat Cycle, Regenerative Cycle, Binary Vapor Cycle, Air standard Otto Cycle, Air standard Diesel Cycle, Air Standard Dual Cycle, Comparison of Otto, Diesel & Dual Cycles, Air Standard Brayton Cycle, Reversed Carnot Cycle as a Refrigeration Cycle, Vapour Compression Cycle, Refrigerants, Absorption Refrigeration System, Gas Refrigeration Cycle.</td></tr>
<tr><td>VI</td><td>Text/References</td><td colspan="4">1. Thermodynamics: An Engineering Approach: Cengel Y and Boles M. McGraw Hill India, 2011.
2. Introduction to Thermodynamics: Rao Y V C. Orient Longman, 2009.
3. Engineering Thermodynamics: Nag P K. McGraw Hill India, 2013.
4. Fundamentals of Thermodynamics: Borgnakke C and Sonntag R E. Wiley, 2009.</td></tr>
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<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">ME 2004</td></tr>
<tr><td>II</td><td>Course Title</td><td colspan="4">Manufacturing Process</td></tr>
<tr><td rowspan="2">III</td><td rowspan="2">Credit Structure</td><td>L</td><td>P</td><td>T</td><td>C</td></tr>
<tr><td>2</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>IV</td><td>Prerequisite(If any for the student)</td><td colspan="4">Nil</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">Classification of Metal Removal Processes and Machine tools: Introduction to Manufacturing and Machining, Basic working principle, configuration, specification and classification of machine tools. Mechanics of Machining (Metal Cutting) and Machinability: Geometry of single point cutting tools, Conversion of tool angles from one system to another, Mechanism of chip formation, Orthogonal and oblique cutting, Use of chip breaker in machining, Machining forces and Merchants Circle Diagram (MCD), Analytical and Experimental determination of cutting forces, Dynamometers for measuring cutting forces, Cutting temperature causes, effects, assessment and control, Control of cutting temperature and cutting fluid application, Concept of Machinability and its Improvement, Failure of cutting tools and tool life, Cutting Tool Materials of common use Advanced Cutting Tool Materials. Basics of machining Processes: Turning, milling, drilling, boring, abrasive processes, super-finishing processes etc. Welding: Introduction: Principle of welding, general applications such as construction of bridges, towers, automobiles & electronic circuits, etc. Classification of welding processes, Soldering and brazing. Welded Joints: Introduction to AWS standards. Manual metal arc (MMA) or shielded metal arc (SMA) welding, Submerged arc welding (SAW). Gas metal arc welding (GMAW) or MIG/MAG welding, TIG welding, Resistance welding. Metal Forming and Sheet Metal Working: Elastic and plastic deformation. Concept of strain hardening. Hot and cold working processes -rolling, forging, extrusion, swaging, wire and tube drawing. Machines and equipment for the processes. Parameters and force calculations. Test methods for formability. Blanking, Punching, piercing, bending, drawing etc. Introduction to Plastics & their Processing: Introduction to plastics, Injection moulding, Extrusion, Blow moulding, calendering, etc. Jigs and Fixtures: Purposes of jigs and fixtures and their Design principles, Design and Application of typical jigs and fixtures. Metrology: Introduction to Metrology, Machines and Equipment used for measurements. Design of Experiments: Introduction to DoE, Taguchi, RSM. Case studies related to few engineering products/processes.</td></tr>
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		Laboratory Experiments: 1. Effect of various welding parameters on tensile strength of weld for TIG, MIG and resistance welding operations. 2. Measurement of forces during press working. 3. Jigs and Fixtures. 4. Machine tool alignment tests. 5. Design of experiments using Minitab. 6. Tool life measurement. 7. Determination of cutting forces measurement during turning, drilling and milling. 8. Determination of surface roughness after various machining operations. 9. Practical exposure to various metrology equipments. 10. Group project.
VI	Text/References	1. Shaw.M.C. Metal cutting principles, Oxford Clare Don Press, 1984. 2. Bhattacharya.A., Metal Cutting Theory and Practice, Central Book Publishers, India, 1984. 3. Boothroid D.G. & Knight W.A., Fundamentals of machining and machine tools, 4. Marcel Dekker, Newyork, 1989. 5. Serope Kelpekijian & Stefan R. Schmidt. Manufacturing process engineering materials, 2003 6. Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, 7. Eswar Press, Chennai, 2004. 8. Dieter G.E., Mechanical Metallurgy (Revised Edition II) McGraw Hill Co., 2004 9. ASM Handbook Vol.6. Welding Brazing & Soldering, 2003

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Semester : 4

I	Course Code	**ME 2005**			
II	Course Title	**Introduction to Design and Innovation**			
III	Credit Structure	L	P	T	C
		3	2	0	4
IV	Prerequisite(If any for the student)	Nil			
V	Course Content	Understanding of the design process that underlies any design undertaking; Concept of ideal design, conceptualizing product, visualization, preliminary estimates, material selection, engineering economics, ergonomics and aesthetics; Other aspects of design such as risk and liability, ethics, and impact on society and the environment. Prototyping & Rapid Prototyping, Prototyping to Productionisation. Laboratory Experiments: Open Ended Projects			
VI	Text/References	1. Engineering Design: A Project Based Introduction, 4th Edition by Clive L. Dym, Patrick Little, and Elizabeth J. Orwin. Wiley India, 2015. 2. Engineering Design, 5th Edition by George E. Dieter and Linda C. Schmidt. McGraw Hill, 2013. 3. The Design of Everyday Things (Revised and Expanded Edition) by Don Norman. Basic Books, 2013. 4. Advances in Integrated Design and Manufacturing in Mechanical Engineering by Alan Bramley,Daniel Brissaud, Daniel Coutellier, and Chris McMahon (Eds.).Springer, 2005.			

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I	Course Code	**ME 2501**			
II	Course Title	**Lab Oriented Project/Study Oriented Project**			
III	Credit Structure	L	P	T	C
		0	3	0	2
IV	Prerequisite(If any for the student)	Nil			
V	Course Content	This course includes projects involving laboratory/theoretical investigation or laboratory development in the students discipline or interdisciplinary areas. These courses must concluded with project reports.			
VI	Text/References	Nil			