

# BACHELOR OF TECHNOLOGY

Mechanical Engineering Department

Semester - V

Course Scheme

Course Code	Course Name	Lecture hours	Tutorial hours	Practical hours	Credit
HS 203001	HSS – 3 (Advanced English)	3	0	0	3
ME 203001	Advanced Manufacturing Processes	2	1	3	4.5
ME 203002	Introduction to Machine Design	3	1	0	4
ME 203003	Theory of Machines & Mechanisms	3	1	2	5
ME 203004	Heat and Mass Transfer	3	1	2	5
	<b>Total</b>	<b>14</b>	<b>4</b>	<b>7</b>	<b>21.5</b>

**Mechanical Engineering Department**  
**Semester - V**

I	Course Code	<b>HS 203001</b>			
II	Course Title	<b>HSS – 3 (Advanced English)</b>			
III	Credit Structure	L	T	P	C
		3	0	0	3
IV	Prerequisites (if any)	Nil			
V	Course Coordinator	Dr Meera Vasani & Dr Wati Longkumer			
VI	Course Objective	<ul style="list-style-type: none"> <li>-To develop oral skills with emphasis on conversational practice</li> <li>-To advance writing skills through guided composition</li> <li>-To equip the students with the basics right of communication and presentation skills for academic and professional purposes</li> <li>-To assist the second language learners acquire fluency in both spoken and written English to communicate information with clarity, precision and confidence especially in the professional sphere.</li> </ul>			

VII	Course Contents	<p><b>Remedial grammar:</b>          -Basic language structures with focus on practice, and the use of fundamental grammatical elements.          -Reading Comprehension          -Guided and free composition <u>essays of expository, descriptive, narrative, argumentative, and reflective types.</u></p> <p><b>Speaking &amp; Writing:</b>          Rhetorical devices- Logos/Pathos/Ethos</p> <p><b>Reading:</b>          What is Reading?          Types of Reading          Critical reading</p> <p><b>Writing:</b>          Preparing technical project report: Abstract, Acknowledgment Report Writing          CV/Resume/Bio-data</p> <p><b>Literature:</b>  <u>Short essays/articles</u>          -Bon Bibi Legend and 'Ethnic Cleansing' of India's Forests: Amitav Ghosh          -The Danger of a Single Story: Chimamanda Ngozi Adiche          -Mother Tongue: Amy Tan          -List of 7 Rules for Beginning Writers: V.S. Naipaul (more to be included, if needed)</p> <p><u>Classic Short stories</u>          -The Cactus: O Henry          -A Child's Dream of a Star: Charles Dickens          -The Man who could work miracles: HG Wells          -My Own True Ghost Story: Rudyard Kipling          -The Music on the Hill: Suki          -Rain: W. Somerset Maugham          -A School Story: M R James          (more to be included, if needed)</p>
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# Mechanical Engineering Department

## Semester : V

I	Course Code	<b>ME 203001</b>			
II	Course Title	<b>Advanced Manufacturing Processes</b>			
III	Credit Structure	L	T	P	C
		2	1	3	4.5
IV	Prerequisite(If any for the student )	Manufacturing Processes			
V	Course Content	<p>Introduction to Advanced Manufacturing Processes; Sustainable manufacturing; Unconventional machining processes and their comparative evaluation; Fundamentals of Additive manufacturing; Advanced analysis of steels and non-ferrous alloys; Advanced modeling tools for manufacturing; Foundations of industrial finite element codes for heat treatment, machining and forming processes. Simulation of different manufacturing processes with FE packages and their experimental validation. Plastics and Composite material manufacturing. Introduction to micro/nano manufacturing. Industry oriented project.</p> <p><b>Laboratory Experiments:</b></p> <ol style="list-style-type: none"> <li>1. Basic practical skills on mechanical machining, data acquisition, filtering and analysis skills.</li> <li>2. Simulation of forming and machining processes using FE package DEFORM 3D and their experimental validation.</li> <li>3. Use of ANSYS and MATLAB for analyzing and solving manufacturing problems.</li> <li>4. Creating 3D models of components using different CAD software and building prototypes using 3D printing machine.</li> <li>5. Experimental investigation of weld quality using TIG and MIG welding techniques.</li> <li>6. Demonstration on Wire-cut EDM.</li> <li>7. Demonstration on Ultrasonic machining setup.</li> <li>8. Composite manufacturing.</li> </ol>			

VI	Text/References	<ol style="list-style-type: none"> <li>1. Ghosh and Mallik, Manufacturing Science, EWP Private Ltd.</li> <li>2. Hassan Abdel, Gabad El Hoffs, Advanced Manufacturing Processes, McGraw Hill.</li> <li>3. V.K.Jain, Advance Machining Processes, Allied Publisher Bombay.</li> <li>4. Pandey P.C., Shan H.S., Modern Machining Processes, Tata McGraw-Hill Education.</li> <li>5. Weller E.J., Non-traditional Machining Processes, Society of Manufacturing Engineers, Publications.</li> <li>6. Stephen P. Campbell, The Science and Engineering of Micro-fabrication, Oxford University Press.</li> <li>7. Gibson, Rosen, Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing. Springer, 2009.</li> <li>8. Davim, J.P, Machining Composite Materials, Wiley-ISTE, 2009.</li> <li>9. Fluhner, J. SFTC Inc. DEFORM 3D User's Manual.</li> <li>10. Works, M. Matlab User Manual Version r2015b. Math Works Incorporation, Natick, MA.</li> </ol>
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# Mechanical Engineering Department

## Semester : V

I	Course Code	<b>ME 203002</b>			
II	Course Title	<b>Introduction to Machine Design</b>			
III	Credit Structure	L	T	P	C
		3	1	0	4
IV	Prerequisite(If any for the student )	Nil			
V	Course Content	<p>Fundamentals of machine design: Design philosophy, Engineering Materials, Brief overview of design and manufacturing</p> <p>Stresses in machine elements: Simple stresses, Compound stresses in machine parts, Strain analysis</p> <p>Design for Strength: Design for static loading, Stress Concentration, Design for dynamic loading, Low and high cycle fatigue, Endurance limit</p> <p>Fasteners: Types of fasteners: Pins and keys, Cotter and knuckle joint, Threaded Fasteners, Design of bolted joints</p> <p>Couplings: Introduction, types and uses, Design procedures for rigid and flexible rubber-bushed couplings</p> <p>Power Screws: Power Screw drives and their efficiency, Design of power screws</p> <p>Design of Springs: Introduction to Design of Helical Springs, Design of Helical Springs for Variable Load, Design of Leaf Springs</p> <p>Design of Shaft: Shaft and its design based on strength, Design of shaft for variable load and based on stiffness</p> <p>Design of Permanent Joints: Riveted Joints Types and Uses, Design of Riveted Joints, Welded Joints Types and Uses, Design of Welded Joints, Design of Adhesive Joints Design of Joints for Special Loading: Design of Eccentrically Loaded Bolted/Riveted Joints, Design of Eccentrically Loaded Welded Joints, Design of Joints with Variable Loading</p> <p>Design of clutches: Design of friction clutches, Design of Centrifugal clutches.</p>			
VI	Text/References	<ol style="list-style-type: none"> <li>1. Design of Machine Elements by Bhandari V. B., Third Edition, McGraw Hill Education, 2010.</li> <li>2. Shigleys Mechanical Engineering Design by Budynas R. G., and Nisbett J. K., Tenth Edition, McGraw Hill Education, 2016.</li> <li>3. Machine Design An Integrated Approach by Norton R. L., Fifth Edition, Pearson India, 2013.</li> <li>4. Design of Machine Elements by Spotts M. F., Shoup T. E., and Hornberger</li> <li>5. L. E., Eighth Edition, Pearson India, 2003.</li> <li>6. A Textbook of Machine Design by Kurmi R. S., and Gupta J. K., S. Chand Publishers, 2005.</li> </ol>			

# Mechanical Engineering Department

## Semester : V

I	Course Code	<b>ME 203003</b>			
II	Course Title	<b>Theory of Machines &amp; Mechanisms</b>			
III	Credit Structure	L	T	P	C
		3	1	2	5
IV	Prerequisite(If any for the student )	None			
V	Course Objective	This course introduces students to the basic concepts of mechanisms and machines and their kinematic analysis. The theoretical foundation, upon which advanced courses such as Machine Design, Dynamics and Vibration, and Robotics are built ,is developed.			
VI	Course Content	<p><b>Introduction:</b> Definitions of Machine, Mechanism, Links, and Pairs; Classification of Mechanisms; Mobility - Kutzbach Equation and Griibler's Criterion; Kinematic Inversion; Grashof 's Law</p> <p><b>Kinematic Analysis and Synthesis:</b> Position and Displacement, Velocity, Acceleration - Graphical and Analytical Methods; Coupler-Curve Generation; Instantaneous Centres of Velocity and Acceleration; Aronhold-Kennedy Theorem of Three Centres; Type, Number and Dimensional Synthesis; Function Generation, Path Generation, and Body Guidance; Coupler Curve Synthesis</p> <p><b>Cams, Gears, and Mechanism Trains:</b> Classification of Cams and Followers, Displacement Diagrams, Graphical Layout of Cam Profiles, Standard Cam Motions; Fundamental Law of Toothed Gearing, Spur Gears, Helical Gears, Bevel Gears, Worms, and Worm Gears; Parallel-Axis Gear Trains, Epicyclic Gear Trains, Differentials</p> <p><b>Introduction to Robotics:</b> Kinematics of Open Chains, Topological Arrangement of Robotic Arms, Forward and Inverse Kinematics</p> <p><b>Laboratory Work:</b> Graphical Analysis of Selected Planar Mechanisms; Cams and Gears; Computer Modelling; Mechanism Design Group Project</p>			
VII	Text/References	<ol style="list-style-type: none"> <li>1. John J. Dicker Jr., Gordon R. Pennock, and Joesph E. Shigley, Theory of Machines and Mechanisms, Fourth Edition (International Version),Oxford University Press, 2015.</li> <li>2. Amitabha Ghosh, and Ashok K. Mallik, Theory of Mechanisms and Machines, Third Edition, East West Press Private Limited, 1998.</li> <li>3. Robert L. Norton, Kinematics and Dynamics of Machinery, First SI Edition, McGraw Hill Higher Education, 2008.</li> <li>4. S. S. Rattan, Theory of Machines, Fourth Edition, McGraw Hill Higher Education, 2014.</li> </ol>			
VIII	Course Outcome	Upon completion of this course, students will be able to use graphical, analytical, as well as basic computational approaches to synthesize planar and simple spatial mechanisms. They will be well equipped to tackle advanced topics involving design and analysis of robots and robotic manipulators.			

# Mechanical Engineering Department

## Semester : V

I	Course Code	<b>ME 203004</b>			
II	Course Title	<b>Heat and Mass Transfer</b>			
III	Credit Structure	L	T	P	C
		3	1	2	5
IV	Prerequisite(If any for the student )	Nil			
V	Course Content	<p>Introduction, Modes of heat transfer: Conduction, Convection, Radiation, Material properties of importance in heat transfer, Thermal conductivity, Specific heat capacity.</p> <p>Conduction: One Dimensional steady-state conduction through homogeneous and composite plane walls, One-dimensional steady-state conduction through cylinders and spheres, Critical thickness of insulation, Heat transfer from fins of uniform cross section, Heat conduction in bodies with heat sources, Transient heat conduction, Lumped system analysis, Numerical methods in heat conduction.</p> <p>Convection: Free and Forced, Fundamentals, Velocity and thermal boundary layer, Conservation equations for mass, momentum and energy, solution of boundary layer equations. Non-dimensional numbers, Laminar and turbulent flows, External forced convection: Drag and heat transfer, parallel flow over flat plates, flow across cylinders and spheres, Internal forced convection: Mean velocity and mean temperature, entrance region, constant heat flux and temperature condition in pipe flow, HagenPoiseuille flow, Turbulent flow and heat transfer, Natural/free convection: Equation of motion of Grashof number, natural convection over surfaces and inside enclosures</p> <p>Thermal Radiation, Kirchoffs law; Plancks distribution law, Wiens displacement law. Stefan-Boltzmanns relation, Configuration factors, Radiant interchange between black and grey surfaces, Radiation shielding solar radiation. Heat exchanger, Combined heat transfer analysis, overall heat transfer co-efficient, Types of heat exchangers, LMTD and NTU methods of heat exchanger design, Simple heat exchanger calculations.</p> <p>Boiling and condensation, Boiling heat transfer: pool boiling and flow boiling, Condensation heat transfer, film condensation</p> <p>Mass Transfer, Introduction, analogy between heat and mass transfer, mass diffusion, Ficks Law, boundary conditions, Steady mass diffusion through a wall, cylinder and sphere, Transient mass diffusion, mass transfer in a moving medium, diffusion of vapor through a stationary gas: Stefan Flow.</p>			

		<p><b>Laboratory Experiments:</b></p> <ol style="list-style-type: none"> <li>1. Heat Conduction and Convection Through Extended Surface</li> <li>2. Unsteady State Heat Transfer</li> <li>3. Heat Transfer in Natural Convection</li> <li>4. Laws of Radiant Heat Transfer and Radiant Heat Exchange</li> <li>5. Dropwise and Filmwise Condensation</li> <li>6. Heat Transfer Through Lagged Pipe</li> <li>7. Critical Heat Flux</li> <li>8. Parallel and Counterflow Heat Exchanger</li> <li>9. Diffusion in Liquids and Gases</li> </ol>
VI	Text/References	<ol style="list-style-type: none"> <li>1. Holman JP and Bhattacharya S, Heat Transfer, 10th Edition, McGraw Hill Education.</li> <li>2. Incropera, F.P. and DeWitt, D.P., Principles of Heat and Mass Transfer, 7th Edition, Wiley publications.</li> <li>3. Nag, P.K. (2002). Heat and Mass Transfer, TMH.</li> <li>4. Thirumaleshwar, M. (2006). Fundamentals of Heat and Mass Transfer, Pearson education.</li> <li>5. Ghoshdastidar, P.S. (2004). Heat Transfer. Oxford University Press.</li> <li>6. Arora, Domkundwar, S. and Domkundwar, A. (1988). A Course in Heat &amp; Mass Transfer, Dhanpat Rai &amp; Co.</li> <li>7. Incropera, F.P. and DeWitt, D.P. (2002). Fundamentals of Heat and Mass Transfer, John Willy &amp; Sons, New York, NY.</li> <li>8. John R.Howell&amp; Richrd O Buckius, Fundamentals of Engg. Thermodynamics, McGraw Hill International.</li> <li>9. Holman, J.P. (1997). Heat Transfer, 9th edition, McGraw-Hill.</li> <li>10. Mills, A.F. (1999). Basic Heat and Mass Transfer. Prentice-Hall</li> </ol>