

Title: Minor in Mechanical Engineering

To be offered from July 2023

ME201M Manufacturing Technology (3-0-0-6) ----- For semester 3

Introduction to manufacturing processes: Moulding materials and mould design; Pattern types and design. Casting processes: sand casting, investment casting, pressure die casting, centrifugal casting, continuous casting; elementary analyses, casting defects; Metal forming Processes: Various metal forming techniques: forging, rolling, extrusion, wire drawing, sheet metal working; Metal forming defects. Metal joining processes: brazing, soldering, welding: Solid state welding, resistance welding, arc welding, gas welding; Polymer fabrication methods: Injection moulding, Compression moulding, Transfer moulding, Thermoforming; FRP composite fabrication methods: Compression moulding, Vacuum moulding, Prepreg fabrication, Filament winding; Additive manufacturing; Powder metallurgy and its applications.

Texts:

1. Ghosh and A. K. Mallik, *Manufacturing Science*, Wiley Eastern, 2010.
2. P. N. Rao, *Manufacturing Technology: Foundry, Forming and Welding*, Tata McGraw Hill, 2017.
3. M. P. Groover, *Introduction to Manufacturing Processes*, Wiley, 2011.

References:

1. J. S. Campbell, *Principles of Manufacturing Materials and Processes*, Tata McGraw Hill, 1995.
2. M. C. Flemings, *Solidification Processing*, Tata McGraw Hill, 1982.
3. P. C. Pandey and C. K. Singh, *Production Engineering Sciences*, Standard Publishers, 2013.
4. S. Kalpakjian and S. R. Schmid, *Manufacturing Processes for Engineering Materials*, Pearson education, 2016.

ME202M Thermodynamics (3-0-0-6) ----- For semester 4

Thermodynamic systems, States, Processes, Concepts of Heat and Work, Zeroth law, First law for open and closed systems; Second law: Carnot cycle; entropy; Corollaries of the second law; Properties of pure substances and steam, Mollier diagram; Thermodynamic cycles; Air standard cycles – Otto, Diesel and Brayton cycles, Vapour power cycle – Rankine cycle, Refrigeration cycle – Reversed Carnot cycle, Vapour compression cycle, Introduction to psychrometry; Introduction to steam and gas turbine power plants; Rotary compressors and turbines, Reciprocating air compressors.

Texts:

1. Y. A. Cengel and M. A. Boles, *Thermodynamics – An Engineering Approach*, Tata McGraw Hill, 2003.
2. G F C Rogers and Y R Mayhew, *Engineering Thermodynamics Work and Heat Transfer*, Pearson, 2003.
3. T. D. Eastop and A. McConkey, *Applied Thermodynamics for Engineering Technologists*, Pearson, 1999.

References:

1. R. E. Sonntag, C. Borgnakke and G. J. Van Wylen, *Fundamentals of Thermodynamics*, John Wiley, 2003.
2. P. K. Nag, *Engineering Thermodynamics*, Tata McGraw Hill, 2005.
3. H. I. H Saravanamuttoo, G. F. C. Rogers and H. Cohen, *Gas Turbine Theory*, Pearson, 2003.

ME301M Mechanical Design (3-0-0-6) ----- For semester 5

Principles of mechanical design, and concepts of safety factor and standards; Introduction to stresses and strains, 2D transformations, principal stresses and strains, and Mohr's circle; Properties of engineering materials; Stresses in thin and thick pressure vessels; Axial loading; Bending moment and shear forces in beams, Pure bending and deflection of beams due to bending; Pure torsion of circular rods; Buckling of columns with pinned and other support conditions; Design of shafts; Design of helical and multi-leaf spring springs; Design of belt drives; Introduction to gears, keys, coupling, clutches, brakes, bearings, and power screws; Introduction to fatigue analysis.

Texts:

1. V. B. Bhandari, *Introduction to Machine Design*, Tata McGraw-Hill, 2003.
2. E. P. Popov, *Engineering Mechanics of Solids*, Prentice Hall, 1998.

References:

1. J. E. Shingley, *Mechanical Engineering Design*, McGraw-Hill, 1989.
2. Design Data, PSG Tech, Coimbatore, 1995.
3. S. H. Crandall, N. C. Dahl and T. J. Lardner, *An Introduction to the Mechanics of Solids*, Tata McGraw-Hill, 2008.
4. H. H. Burr and J. B. Cheatham, *Mechanical Analysis and Design*, Prentice Hall, 1997.

ME302M Fluid Mechanics (3-0-0-6) ----- For semester 6

Basic concepts and properties of fluids, Fluid Statics; Fluid Kinematics: Lagrangian and Eulerian description; Reynolds transport theorem, Conservation equations: Bernoulli equation and its applications, Dimensional analysis: Buckingham Pi theorem; Internal and external viscous flows; Fluid machinery: Euler-equation for Turbomachines; Impulse turbine – Pelton wheel; Reaction turbine – Francis turbine, propeller turbine; Centrifugal pump; Reciprocating Pumps; Performance parameters and characteristics of pumps and turbines.

Texts:

1. F. M. White, *Fluid Mechanics*, Tata McGraw-Hill, 2008.
2. R. W. Fox, A. T. McDonald and P. J. Pritchard, *Introduction to Fluid Mechanics*, John Wiley, 2004.
3. Y. A. Cengel and J. M. Cimbala, *Fluid Mechanics*, Tata McGraw-Hill, 2010.

References:

1. B. R. Munson, D.F. Young, and T.H. Okhiishi, *Fundamentals of Fluid Mechanics*, Wiley India, 2002.
2. S. L. Dixon, *Fluid Mechanics and Thermodynamics of Turbomachinery*, Elsevier, 1998.

ME401M Machining Processes (3-0-0-6) ----- For semester 7

Metal cutting: mechanics, tool geometry, tool materials, tool life, chip formation; cutting fluids and surface finish; economics of machining; Generation and machining principles; Basic machining operations: lathe, milling, shaping, drilling, boring, grinding, thread cutting, gear cutting; CNC machines; Finishing: microfinishing, nano-finishing; Non-conventional machining: electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining; Rapid manufacturing and rapid tooling; Basic concepts of CAD/CAM and CAPP.

Texts:

1. A. Ghosh and A. K. Mallik, *Manufacturing Science*, East West Press, 2010.
2. G. K. Lal, *Introduction to Machining Science*, New Age, 2007.
3. W. A. Knight and G. Boothroyd, *Fundamentals of Metal Machining and Machine Tools*, CRC Press, 2006.

References:

1. Production Technology HMT, Tata McGraw Hill, 2001.
2. M. C. Shaw, *Metal Cutting Principles*, Second Edition, Oxford University Press, 2005.
3. P. K. Mishra, *Nonconventional Machining*, Narosa Publishing House, 2007.
4. C. Donaldson, G. H. LeCain, V. C. Goold and J. Ghose, *Tool Design*, Tata McGraw-Hill, 2012.
5. M. P. Groover, *Fundamentals of Modern Manufacturing, Materials, Processes and Systems*, Wiley India, 2007.