Mechanical Engineering

Semester - II						
S. No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MA11T	Calculus and Vector Calculus	3	0	0	6
2	ME102T	Engineering Graphics	1.5	0	3	6
3	ME206T	Thermodynamics	3	0	0	6
4	CS 201	Data Structures and Algorithms	3	0	0	6
5	CS 211	Data Structures and Algorithms Laboratory	0	0	3	3
6	ME204T	Manufacturing Process I	3	0	0	6
7	ME103T	Engineering Metrology and Measurements	3	0	0	3
8	CC	NSO/NSS/NCC/NCA	0	0	2	2
		Total Credits				**38**

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1	**Title of the course** (L-T-P-C)	**Data Structures and Algorithms** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Exposure to Computer Programming
3	**Course content**	Introduction: data structures, abstract data types,analysis of algorithms. Creation and manipulation of data structures: arrays,lists, stacks, queues, trees, heaps, hash tables, balanced trees, tries, graphs. Algorithms for sorting and searching, order statistics, depth-first and breadth-first search, shortest paths and minimum spanning tree.
4	**Texts/References**	**1.** Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Pressand McGraw-Hill, 2009. **2.** Data structures and algorithms in C++, by Michael T. Goodrich, Roberto Tamassia, and David M. Mount,Wiley, 2004.

1	**Title of the course** (L-T-P-C)	**Data Structures and Algorithms Laboratory** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	Exposure to Computer Programming (CS 102)
3	**Course content**	Laboratory course for CS 211 is based on creatingand manipulating various data structures and implementation of algorithms.
4	**Texts/References**	**1.** Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Pressand McGraw-Hill, 2009. **2.** Data structures and algorithms in C++, by Michael T.Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.

1	**Title of the course (L-T-P-C)**	**Calculus and Vector Calculus** **2-1-0-6**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Calculus Foundations (single variable scalar functions): Review of limits, continuity, and differentiability, Mean value theorem, Taylor's Theorem, Maxima and Minima. Fundamental theorem of Calculus, Improper integrals Convergence and Series: Convergence of sequences and series, power series. Examples in different coordinate systems Cartesian, Cylindrical, Spherical Multivariable calculus: Riemann integrals, Partial Derivatives, applications to area, volume, change of variables, Jacobian Vector Calculus: Path and Curves, Parametric representation, Vector functions and their Continuity and Differentiability, Gradient of a Scalar Field, Directional Directive, Maxima and Minima in Curl and Divergence of a Vector Field. Line integrals and Green's theorem; Surface areas and integrals. Gauss Divergence theorem and Stokes theorem, Examples of different equations in Mechanics.
4	**Texts/References**	**Textbooks:** 1. B. V. Limaye and S. Ghorpade, A Course in Calculus and Real Analysis, Springer International Publishing (2018) 2. Marsden and Tromba Vector Calculus, Sixth Edition, W H Freema & Co, 2012 **References:** • James Stewart, Daniel K. Clegg, Saleem Watson Calculus (9th Edition), Cengage (2021) • T. M. Apostol, Calculus, Volume 1, Wiley Eastern (1980) • Erwin Kreyszig, Herbert Kreyszig, Edward J. Norminton, Advance Engineering Mathematics (10th Edition), John Wiley (2010)

1	**Title of the course** (L-T-P-C)	**Engineering Graphics** **1.5-0-3-6**
2	**Pre-requisite courses(s)**	--
3	**Course content**	• Introduction to Engineering Graphics a) Drawing sheet conventions b) Lines, Lettering, Dimensioning and Scales • Use of mini-draft and basic software skills for drafting • Basic geometrical constructions a) Perpendicular bisector, subdivision of lines and angles b) Construction of regular polygonal shapes c) Finding center of an arc • Curves in 2D – Conic sections, Cycloids, Spirals, Involutes • Orthographic projections • Projection of points • Projection of straight lines • Projection of planes • Projection on auxiliary planes • Projection of solids • Sections of solid • Development of surfaces • Intersection of surfaces • Isometric and Oblique projections • Perspective projection
4	Texts/References	**Textbook:** • N. D. Bhatt, Engineering Drawing, 54th Edition, Charotar Publishing House, 2023. **References:** • Narayana. K. L., and Kannaiah, P. E., Text Book on Engineering Drawing, 2nd Edition, 2013, Scitech Publications, Chennai. • Gopalakrishna K. R., Engineering Drawing Vol. I & II Combined.Subhas Stores, 25th Edition, 2017 • Basant Agrawal and C M Agrawal, Engineering Drawing, 3rd Edition, • McGraw-Hill, 2019.

1	**Title of the course** (L-T-P-C)	**Thermodynamics** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Thermodynamic Systems, properties & state, process &cycle **Heat & Work**: Definition of work and its identification, work done at the moving boundary, Zeroth law, **Properties of pure substance**: Phase equilibrium, independent properties, and equations of state, compressibility factor, Tables of thermodynamic properties & their use, Mollier Diagram **First law**: First law for control mass & control volume for a cycle as well as for a change of state, internal energy & enthalpy, Specific heats; internal energy, enthalpy & specific heat of ideal gases. SS process, Transient processes. **Second Law of Thermodynamics**: Reversible process; heat engine, heat pump, refrigerator; Kelvin- Planck & Clausius statements ,Carnot cycle for pure substance & ideal gas, Concept of entropy; the Need of entropy definition of entropy; entropy of a pure substance; entropy change of a reversible & irreversible processes; principle of increase of entropy, thermodynamic property relation, corollaries of second law, Second law for control volume; SS & Transient processes; Reversible SSSF process; principle of increase of entropy, Understanding efficiency. **Irreversibility and availability**: Available energy, reversible work & irreversibility for control mass and control volume processes; second law efficiency. **Thermodynamic relations**: Clapeyron equation, Maxwell relations, Thermodynamic relation for enthalpy, internal energy, and entropy, expansively and compressibility factor, equation of state, generalized chart for enthalpy. **Thermodynamic Cycles**: Otto, Diesel, Duel and Joule Third Law of Thermodynamics
4	**Texts/References**	**1.** Sonntag R., Claus B. & V. Wylen G, Fundamentals of Thermodynamics, John Wiley, 2000. **2.** G Rogers, YR Mayhew, Engineering Thermodynamics Work and Heat Transfer, Pearson 2003 **3.** J.P Howell, P.O. Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill,1987 **4.** Y Cengal, M A Boles, Thermodynamics: An Engineering Approach, Tata McGraw Hill, 2003. **5.** Michael J. & H.N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley, 2004.

1	**Title of the course** (L-T-P-C)	**Manufacturing Process I** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Exposure to Mechanical Measurements
3	**Course content**	**Casting processes**: dispensable and permanent mould processes; analysis of melting, pouring and solidification phenomena; design of pattern, core, feeder and gating system; casting defects and inspection. **Joining processes**: fusion and solid-state welding; brazing and soldering; weld joint design, cooling rate, and joint properties; welding defects and inspection. **Bulk and Sheet Forming processes**: rolling, forging, extrusion and drawing; sheet metal working; forming limit diagram; loads, friction and lubrication; forming defects and inspection. **Powder processing**: Powder manufacture, characterization, compaction and sintering; metal injection moulding; hot and cold iso-static pressing. Polymers and Composites: Thermoplastics, thermosets, elastomers and composites; related processes; injection mould design; moulding defects and inspection. Advanced processes: Free form fabrication (rapid prototyping), and net shape manufacturing processes.
4	**Texts/References**	1. Ghosh A. and Mallick A.K., Manufacturing Science, Affiliated East West Press, 2001. 2. Rao P.N., Manufacturing Technology- Foundry, Forming and Welding, TMG Hill, 1987. Schey J., Introduction to Manufacturing Processes, Tata McGraw Hill, 2000. 3. DeGarmo E.P., Black J.T., Kohser R.A., Materials and Processes in Manufacturing, PHI, 1997. 4. Pye R.G.W., Injection Mold Design, Longman Scientific & Technical, Essex, 1989.

1	**Title of the course** (L-T-P-C)	**Engineering Metrology and Measurements** **2-1-0-3**
2	**Pre-requisite courses(s)**	--
3	**Course content**	**Introduction to Engineering Metrology** (3 Lectures): What is Metrology, Need for inspection, Physical measurement, Measuring instruments, Selection of instruments, Classification of methods of measurements, Objectives of Metrology, Sources of errors, Linearity, Definition of Accuracy and Precision, Geometry of form of shape **Linear Measurements** (2 Lectures): Steel rule, Calipers, Surface plates, Angle plates, V- Block, Angle gauges, Pitch screw gauge, Vernier instruments, Micrometers, Slip gauges **Limits, Fits and Tolerances** (3 Lectures): Tolerances, Interchangeability, Limits of size, Guide for selection of fits, Plain gauges, Gauges for tapers, Plug and ring gauges, Geometric dimensioning and tolerancing **Comparators (**1 Lecture): Uses of comparators, Advantages and disadvantages of various types of comparators, Mechanical comparators, Electrical and Electronic comparators, Pneumatic comparators **Measurement by light-wave interference** (1 Lecture): Interferometry applied to flatness testing, Interferometers, Laser interferometers **Profile, form and angle measurement** (3 Lectures): Profile and surface measurement using CMM and 3D scanner. Measurement of Straightness, Flatness, Parallelism, Squareness, Circularity, Equidistance and Coincidence. Sine principle and sine bar Spirit level and angle gauges **Measurement of surface finish (**2 Lectures): Meaning of surface texture and some definitions, Surface roughness, Methods of measuring surface finish, Direct instrument measurements, The sample length and cut-off length, Assessment of surface roughness as per Indian standard **Dial indicators and Metrology of screw thread** (1 Lecture): Requirements for good dial indicators, Advantages of dial indicators, Working mechanism of dial indicators, Accuracy of dial indicators, Screw threads terminology, Measurement of various elements of threads **Measurement of Gears** (1 Lecture): Involute curve, Terminology of Gear tooth, Sources of errors in manufacturing gears, Gear measurement, **Machine tool Metrology** (2 Lectures): Alignment tests on Lathe, Alignment tests on Milling Machine, Alignment tests for Shapers, Alignment tests for Surface Grinders **Non-destructive testing of Metals and Alloys** (1 Lecture): Magnetic crack detection method, Penetrant inspection method, Ultrasonic inspection, Electrical / Magnetic method, Hardness test.

4	**Texts/References**	1. Bewoor, A.K. and Kulkarni, V.A., Metrology and measurement. McGraw-Hill Education. 2. Fridman, A.E., The quality of measurements: a metrological reference Springer Science & Business Media. 3. J. A. Sładek Coordinate Metrology Accuracy of Systems and Measurement ISSN2195-9862, Springer publisher 4. R. Leach and S.T. Smith Basics of precision engineering, CRC press 2018 5. Jain, R.K., Engineering Metrology. Khanna Publishers 6. Galyer, J.F.W., Shotbolt, C.R., Metrology for Engineers, ELBS.