**SECOND YEAR MECHANICAL ENGINEERING COURSE**

**SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020**

**SEMESTER –III**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course**  **Code** | **Nomenclature of the Course** | **Scheme of Instruction**  **Hrs/Week** | | | **Scheme of Examination** | | | | | | |
| **L** | **T** | **P** | Duration (Hrs) | Marks | | | | | Credits |
| Th | IA | TW\*\* | P/O | Total |
| ME310 | Mathematics –III | 3 | 1 | -- | 3 | 100 | 25 | 25 | -- | 150 | 4 |
| ME320 | Mechanics of Solids | 4 | -- | -- | 3 | 100 | 25 | -- | 25 | 150 | 4 |
| ME330 | Engineering Thermodynamics | 4 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 4 |
| ME340 | Engineering Materials Science and Metallurgy | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME350 | Engineering Metrology and Machine Drawing | 4 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 4 |
| ME360 | Engineering Materials Science and Metallurgy Laboratory | -- | -- | 2 | -- | -- | -- | 25 | 50 | 75 | 1 |
| ME370 | Engineering Metrology and Machine Drawing Laboratory | -- | -- | 2 | -- | -- | -- | 25 | 50 | 75 | 1 |
| HM001 | Technical Communication | 2 | -- | -- | -- | -- | -- | 75 | -- | 75 | 2 |
| AC390 | Mathematics I & II  (\*Bridge Course) | 2 | -- | -- | -- | -- | -- | -- | -- | -- | 0 |
|  | TOTAL | 22 | 1 | 4 | -- | 500 | 125 | 150 | 125 | 900 | 23 |

\*(This course is compulsory to direct second year/lateral entry students. It is introduced to

reduce the knowledge gap in the students)

\*\*Term Work marks are to be awarded through continuous evaluation

# LEGEND

|  |  |
| --- | --- |
| **Abbreviation** | **Description** |
| L | Lecture |
| T | Tutorial |
| P | Practical |
| O | Oral |
| Th | Theory |
| TW | Term Work |
| IA | Internal Assessment |

**SECOND YEAR MECHANICAL ENGINEERING COURSE**

**SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020**

**SEMESTER –IV**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course**  **Code** | **Nomenclature of the Course** | **Scheme of Instruction**  **Hrs/Week** | | | **Scheme of Examination** | | | | | | |
| **L** | **T** | **P** | Duration (Hrs) | Marks | | | | | Credits |
| Th | IA | TW\* | P/O | Total |
| ME410 | Energy Conversion | 4 | 1 | -- | 3 | 100 | 25 | 25 | -- | 150 | 5 |
| ME420 | Machine Design | 4 | 1 | -- | 3 | 100 | 25 | 25 | -- | 150 | 5 |
| ME430 | Fluid Mechanics | 3 | 1 | -- | 3 | 100 | 25 | 25 | -- | 150 | 4 |
| ME440 | Analysis and Synthesis of Mechanisms | 4 | -- | 2 | 3 | 100 | 25 | 25 | -- | 150 | 5 |
| ME450 | Thermal Laboratory-I | -- | -- | 2 | -- | -- | -- | 50 | 50 | 100 | 1 |
| ME460 | Fluid Mechanics Laboratory | -- | -- | 2 | -- | -- | -- | 50 | 50 | 100 | 1 |
| HM003 | Economics for Engineers | 3 | -- | -- | 3 | 100 | 25 | -- | 25 | 150 | 3 |
|  | TOTAL | 18 | 3 | 6 | -- | 500 | 125 | 200 | 100 | 950 | 24 |

\*Term Work marks are to be awarded through continuous evaluation

# LEGEND

|  |  |
| --- | --- |
| **Abbreviation** | **Description** |
| L | Lecture |
| T | Tutorial |
| P | Practical |
| O | Oral |
| Th | Theory |
| TW | Term Work |
| IA | Internal Assessment |

**THIRD YEARMECHANICAL ENGINEERING COURSE**

**SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020**

**SEMESTER –V**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course**  **Code** | **Nomenclature of the Course** | **Scheme of Instruction**  **Hrs/Week** | | | **Scheme of Examination** | | | | | | |
| **L** | **T** | **P** | Duration (Hrs) | Marks | | | | | Credits |
| Th | IA | TW\* | P/O | Total |
| ME 510 | Manufacturing Technology-I | 4 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 4 |
| ME 520 | Dynamics of Machinery | 4 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 4 |
| ME531 | Advanced Thermodynamics | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME532 | Mechanical Vibrations |
| ME533 | Mechatronics |
| ME534 | Management Information Systems |
| ME535 | Industrial Safety and Occupational Health |
| ME 541 | Gas Dynamics and Turbo Machinery | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME 542 | Engineering Tribology |
| ME 543 | Advanced Machine Design |
| ME 544 | Micro Electro Mechanical Systems |
| ME 545 | Instrumentation & Control |
| ME 570 | Manufacturing Laboratory | -- | -- | 2 | -- | -- | -- | 25 | 50 | 75 | 1 |
| ME 580 | Dynamics of Machinery Laboratory | -- | -- | 2 | -- | -- | -- | 25 | 50 | 75 | 1 |
| \*\*\* | Open Elective | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| HM002 | Technical English & Report Writing | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
|  | TOTAL | 20 | 0 | 4 | -- | 600 | 150 | 50 | 100 | 900 | 22 |

Students to select **ANY ONE** subject from ME531, ME532, ME533, ME534, ME535 as **Professional Elective - I** and **ANY ONE** subject from ME541, ME542, ME543, ME544, ME545 as **Professional Elective – II**

\*Term Work marks are to be awarded through continuous evaluation

# LEGEND

|  |  |
| --- | --- |
| **Abbreviation** | **Description** |
| L | Lecture |
| T | Tutorial |
| P | Practical |
| O | Oral |
| Th | Theory |
| TW | Term Work |
| IA | Internal Assessment |

**THIRD YEARMECHANICAL ENGINEERING COURSE**

**SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020**

**SEMESTER –VI**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course**  **Code** | **Nomenclature of the Course** | **Scheme of Instruction**  **Hrs/Week** | | | **Scheme of Examination** | | | | | | |
| **L** | **T** | **P** | Duration (Hrs) | Marks | | | | | Credits |
| Th | IA | TW\* | P/O | Total |
| ME610 | Heat and Mass Transfer | 4 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 4 |
| ME620 | Manufacturing Technology-II | 4 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 4 |
| ME631 | Power Plant Engineering | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME632 | Advanced Mechanics of Solids |
| ME633 | Fiber Reinforced Composites |
| ME634 | Six Sigma Management |
| ME635 | Applied Operations Research |
| ME641 | Alternative Energy Sources | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME642 | Additive Manufacturing |
| ME643 | Fluid Power Control |
| ME644 | Supply Chain Management |
| ME645 | System Modeling & Simulation |
| ME650 | Thermal Laboratory-II | -- | -- | 2 | -- | -- | -- | 25 | 50 | 75 | 1 |
| ME660 | Manufacturing & Automation Laboratory | -- | -- | 2 | -- | -- | -- | 25 | 50 | 75 | 1 |
| \*\*\* | Open Elective | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| HM010 | Engineering Statistics | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
|  | TOTAL | 20 | 0 | 4 | -- | 600 | 150 | 50 | 100 | 900 | 22 |

Students to select **ANY ONE** subject from ME631, ME632, ME633, ME634, ME635 as **Professional Elective - III** and **ANY ONE** subject from ME641, ME642, ME643, ME644, ME645 as **Professional Elective - IV**

\*\*\* Student will have to enter the course code that he/she takes as part of the open elective.

\*Term Work marks are to be awarded through continuous evaluation

Between 6th & 7th semester - 8 weeks internship/training/research assistantship.

**FOURTH YEAR MECHANICALENGINEERING COURSE**

**SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020**

**SEMESTER –VII**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course**  **Code** | **Nomenclature of the Course** | **Scheme of Instruction**  **Hrs/Week** | | | **Scheme of Examination** | | | | | | |
| **L** | **T** | **P** | Duration (Hrs) | Marks | | | | | Credits |
| Th | IA | TW\* | O | Total |
| ME710 | CAD/CAM | 4 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 4 |
| ME721 | Refrigeration and Air-Conditioning | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME722 | Finite Element Method |
| ME723 | Quality & Reliability |
| ME724 | Advanced Optimization |
| ME725 | Tool Engineering |
| ME730 | CAD/CAM Laboratory | -- | -- | 2 | -- | -- | -- | 25 | 50 | 75 | 1 |
| \*\*\* | Open Elective | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME740 | Internship | -- | -- | 6 | -- | -- | -- | 50 | 50 | 100 | 3 |
| ME750 | Project Work- PHASE I | -- | -- | 6 | -- | -- | -- | 50 | 75 | 125 | 3 |
|  | TOTAL | 10 | 0 | 14 | -- | 300 | 75 | 125 | 175 | 675 | 17 |

Students to select **ANY ONE** subject from ME721, ME722, ME723, ME724, and ME725 as **Professional Elective – V**

\*Term Work marks are to be awarded through continuous evaluation

\*\*\* Student will have to enter the course code that he/she takes as part of the open elective.

# LEGEND

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| **Abbreviation** | **Description** |
| L | Lecture |
| T | Tutorial |
| P | Practical |
| O | Oral |
| Th | Theory |
| TW | Term Work |
| IA | Internal Assessment |

**FOURTH YEAR MECHANICALENGINEERING COURSE**

**SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020**

**SEMESTER –VIII**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course**  **Code** | **Nomenclature of the Course** | **Scheme of Instruction**  **Hrs/Week** | | | **Scheme of Examination** | | | | | | |
| **L** | **T** | **P** | Duration (Hrs) | Marks | | | | | Credits |
| Th | IA | TW\* | O | Total |
| ME810 | Industrial Engineering and Operations Management | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME821 | Energy Conservation and Management | 3 | -- | -- | 3 | 100 | 25 | -- | -- | 125 | 3 |
| ME822 | Automobile Engineering |
| ME823 | Industrial Automation and Robotics |
| ME824 | Maintenance Engineering and Management |
| ME825 | Computational Fluid Dynamics |
| ME830 | (nptel/mooc/swayam) student can take this on-line course between 6 to 8 sem. grades will be awarded in 8th sem. | 3 | -- | -- | -- | -- | -- | 50 | 50 | 100 | 3 |
| ME840 | Project Work- phase II | -- | -- | 18 | -- | -- | -- | 200 | 200 | 400 | 9 |
|  | TOTAL | 9 | 0 | 18 | -- | 200 | 50 | 250 | 250 | 750 | 18 |

**#** Students to select **ANY ONE** subject from ME821, ME822, ME823, ME824, and ME825 as **Professional Elective – VI**

\*Term Work marks are to be awarded through continuous evaluation

**LEGEND**

|  |  |
| --- | --- |
| **Abbreviation** | **Description** |
| L | Lecture |
| T | Tutorial |
| P | Practical |
| O | Oral |
| Th | Theory |
| TW | Term Work |
| IA | Internal Assessment |

**SYLLABUS**

**SECOND YEAR MECHANICAL ENGINEERING SYLLABUS**

**SEMESTER III**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mathematics - III** | | | | | |
| **Course Code** | **ME310** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **3** | **1** | **0** | **42 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 150 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **25** | **100** | **0** | **0** |

**Course Objectives:**

The course is intended at making students understand fundamentals of Mathematics necessary to formulate, solve and analyze engineering problems.

**Course Outcomes:**On completing this course students will be able to:

|  |  |
| --- | --- |
| CO 1 | Understand the theory of matrices, Laplace transforms, Fourier Series, Probability theory and the formulation of one dimensional wave equation, heat flow equation and its solution. |
| CO 2 | Compute the rank of matrix, eigen values and eigen vectors of a matrix, Laplace/ inverse transform of functions, Fourier Series of functions and Probability of events. |
| CO 3 | Use rank of a matrix to analyze solutions of linear systems of equations. Solve differential /integral equations using Laplace transforms. Use Fourier series to find the solution of Partial differential equations such as wave equations and heat flow equations. |
| CO 4 | Model real life problems with matrices, use probability for estimation. Propose a value to be substituted in a Fourier series to obtain the given real number series. |

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| **UNIT-1** | **11 Hrs** |
| **Matrices :** Types of matrices, Determinant, inverse of matrix, Elementary transformations, Elementary matrices, Rank of matrix, Reduction to normal form, Canonical form, Rank using elementary transformation, Linear independence and dependence of vectors, System of the form AX = 0, and AX = B, and their solutions, Eigen values, Eigen vectors with properties, Cayley-Hamilton theorem with its applications, minimal polynomial, Diagonalization. |  |
| **UNIT-2** | **11 Hrs** |
| **Laplace Transforms:** Definition. Existence conditions, properties, inverse Laplace transforms. Laplace transform of periodic functions, Convolution theorem, Laplace transform of Dirac-Delta function, Application of Laplace transforms in solving linear differential equations with initial conditions and system of linear simultaneous differential equations. |  |
| **UNIT-3** | **10 Hrs** |
| **Fourier Series :** Periodic functions, Trigonometric series, Euler’s formulae, Dirichlet’s condition, Even and odd functions, Half range series, Parseval’s identity. Partial Differential Equations: Derivation and solution of one dimensional wave equation using separation of variable method. Derivation and solution of one dimensional heat equation using separation of variable method. |  |
| **UNIT -4** | **10 Hrs** |
| **Probability:** Definition, properties, Axioms of probability, conditional probability, theorem on total probability, Baye’s theorem; Random variables-discrete & continuous; Expectation and Variance, Standard deviation, Moment Generating Function & properties, Standard distributions: discrete-Binomial, Geometric & Poisson; continuous- Uniform, Normal, exponential. |  |

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| **TEXTBOOKS** | |
| 1 | B. S. Grewal;Higher Engineering Mathematics; Khanna Publications, New Delhi |
| 2 | Veerarajan; Engineering Mathematics; Tata McGraw Hill Publications |
| 3 | Montgomery, D. C., Probability and Statistics for Engineers; Prentice Hall of India. |
| **REFERENCES** | |
| 1 | P. Kandasamy; Engineering Mathematics; Chand & Co., New Delhi. |
| 2 | Srimanta Pal, Subodh C. Bhunia; Engineering Mathematics; Oxford University Press |
| 3 | Erwin Kreyzing; Advanced Engineering Mathematic; New International Limited. |
| 4 | D. S. Chandrasekhraiah;Engineering Mathematics- Part III ; Prism Books Pvt. Ltd |

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| **MECHANICS OF SOLIDS** | | | | | |
| **Course Code** | **ME320** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **4** | **0** | **0** | **56 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 150 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **0** | **100** | **0** | **25** |

**Course Objectives:**

To identify stress, strain and deformation due to external loads.To perform two dimensional stress and strain analysis. To understand the behaviouralresponse of beams, struts, columns, cylinders and trusses to forces. To apply various failure theories and energy methods.

**Course Outcomes:**On completing this course students will be able to:

|  |  |
| --- | --- |
| CO 1 | Understand fundamentals of stress and strain |
| CO 2 | Understandand apply bending, deflection of beams and truss and usestatics to solve problems. |
| CO 3 | Understand Torsion and solve combined loading problems understand theories of failure. |
| CO 4 | Understand columns, thick and thin cylinders, energy methods. |

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| **UNIT-1** | **14 Hrs** |
| Introduction: Review of engineering mechanics, static analysis of rigid systems. Introduction to Stress and Strain. Hooke’s law, Poisson’s ratio, Generalized Hooke’s law, modulus of rigidity, bulk modulus, relation between material constants.Uniaxial Deformation: Uniaxial tension and compression, temperature stresses, statically indeterminate systems.Two Dimensional Stress and Strain Analysis: Analysis of two dimensional stress and strain, stress and strain analysis using Mohr’s circle, strain gage rosettes. |  |
| **UNIT-2** | **14 Hrs** |
| **Properties of Areas:** Review of Moments of inertia and polar moment of Inertia, Product of inertia, Principal axes, Principal moments of inertia, Mohr’s circle for Moment of Inertia.  **Beams:** Bending moment and shear force in beams, relation between them, sign convention, Bending stresses in beams- Flexure formula, Shear stresses in beams, deflection of beams (using double integration method, singularity functions method).  **Statically Determinate Trusses:** Analysis by method of joints and method of sections in simple statically determinate trusses. |  |
| **UNIT-3** | **14 Hrs** |
| **Torsion:** Torsion of solid and hollow circular shafts. Application of torsion to close and open coiled helical springs.  **Theories of Failure:** Various theories of failures and their limitations comparison and applications.  **Combined Loading:** Shafts subjected to bending moment and twisting moment, members subjected to bending and direct tension/ compression. |  |
| **UNIT -4** | **14 Hrs** |
| **Struts and Columns:** Struts and core of section, stability of columns, Euler’s critical load, for different end conditions of column, empirical formulae for buckling load.  **Introduction to Energy Methods:** Strain energy under different loading conditions, Maxwell-Betti reciprocal theorem, Castigliano’s theorems, deflection of structures using virtual load method. Theorem of minimum potential energy, complementary strain energy.  **Thick and Thin Cylinders:** Thin cylinders subjected to internal pressure, Thick cylinders subjected to internal pressure, Lame’s equation. |  |
| **ASSIGNMENTS**  Four assignments, one on each unit to be submitted within the given deadline. |  |

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| **TEXTBOOKS** | |
| 1 | S. Ramamrutham; Strength of Materials; Dhanpat Rai Publishing Co. (P) Ltd. |
| 2 | S. S. Bhavikatti; Strength of Materials; Vikas Publishing House Pvt Ltd. |
| **REFERENCES** | |
| 1 | S. P. Timoshenko, D. H. Young; Elements of Strength of Materials, East West. |
| 2 | Beer Ferdinand, Johnson E. Russel; Mechanics of Materials, Mc Graw Hill Books. |
| 3 | S. Sreenath; Strength of Materials; Tata McGraw-Hill Education. |

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| **ENGINEERING THERMODYNAMICS** | | | | | |
| **Course Code** | **ME330** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **4** | **0** | **0** | **56 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 125 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **0** | **100** | **0** | **0** |

**Course Objectives:**

To learn the principles of work and energy.To acquire knowledge about the fundamentals of thermodynamic laws, concepts and principles.To understand the principles of various cycles and to apply the thermodynamic concepts in various applications like IC engines and Air conditioning systems

**Course Outcomes:**On completing this course students will be able to:

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| --- | --- |
| CO 1 | Define the fundamentals of the first and second laws of thermodynamics and explain their application to a wide range of systems |
| CO 2 | Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations. |
| CO 3 | Analyse the work and heat interactions associated with a prescribed process path and to perform analysis of a flow system. |
| CO 4 | Apply the concepts of thermodynamics and analyse the energy balances in practical applications |

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| **UNIT-1** | **14 Hrs** |
| **FIRST LAW OF THERMODYNAMICS**  Internal Energy, Law of Conservation of Energy, First Law of Thermodynamics, Application of First Law to a Process, Energy—A Property of System, Perpetual Motion Machine of the First Kind-PMM1, Energy of an Isolated System, Application of First Law of Thermodynamics to Non-flow or Closed System, Application of First Law to Steady Flow Process, Energy Relations for Flow Process, Engineering Applications of Steady Flow Energy Equation (S.F.E.E.)  **SECOND LAW OF THERMODYNAMICS**  Limitations of First law of thermodynamics, Cyclic devices, Directional constraints, Thermal energy reservoirs. Heat engines, refrigerators/heat pump, Statements – Kelvin- Planck &Clausius, Mathematical interpretations with efficiency, COP, Ton of Refrigeration, Equivalence of statements with illustrations, Perpetual motion machine of second kind, Reversibility and irreversibility – causes and conditions. Carnot Theorems, Absolute temperature scale. |  |
| **UNIT-2** | **14 Hrs** |
| **ENTROPY**  Clausius Inequality, Entropy – property, Temperature entropy plane – all standard reversible processes (including polytropic process) with calculation for entropy change on T-S plane, Problem solving & solution procedure. Entropy change - irreversible process, flow processes, concept of lost work, entropy generation – applications, entropy as a measure of disorder.  **AVAILABILITY AND IRREVERSIBILITY**  Available and Unavailable Energy, Available Energy Referred to a Cycle, Decrease in Available Energy When Heat is Transferred Through a Finite Temperature Difference, Availability in Non-flow Systems, Availability in Steady-flow Systems, Helmholtz and Gibb’s Functions, Irreversibility. |  |
| **UNIT-3** | **14 Hrs** |
| **PROPERTIES OF PURE SUBSTANCE**  Definition, P-V-T surface, P-V, P-T diagram, T-S diagram of pure substance, h-s diagram or Mollier chart, Quality or Dryness Fraction, Steam tables – Reading and use of various tables & calculations, Measurement of steam quality.  **VAPOUR POWER CYCLE**  Simple steam power cycle, Basic Rankine cycle with derivation, mean temperature of heat addition, Work ratio, steam rate, heat rate, Carnot efficiency and comparative analysis, modified Rankine- reheat, regenerative (ideal & actual) with deviation of cycles, derivation & calculation – efficiency. |  |
| **UNIT -4** | **14 Hrs** |
| **AIR STANDARD CYCLES**  Air standard assumptions, Overview of reciprocating engines, Air standard cycles for reciprocating engines – Otto, Diesel & dual, Criteria for comparison & comparative analysis, Derivation for efficiency, Mean effective pressure (MEP)  Brayton Cycle: Ideal cycle for gas turbine engines, Deviation of actual cycle, Enhancement – with regeneration, with reheating, with intercooling and combination,  **REFRIGERATION CYCLES**  Air Refrigeration Cycle (Reversed Brayton Cycle), Vapour compression and absorption systems with deviations, Derivation – COP, comparative analysis, first and second law analysis, use of P-h Chart. |  |

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| **TEXTBOOKS** | |
| 1 | Y. A. Cengel, M. A. Boles; Thermodynamics – An Engineering Approach; Tata McGraw Hill Education Pvt. Ltd. New Delhi.4th Ed; 2012. |
| 2 | P. K Nag; Engineering Thermodynamics; Tata McGraw Hill Education Pvt. Ltd.; New Delhi.4th Ed.; 2008. |
| **REFERENCES** | |
| 1 | G. V. Wylen; R. Sonntag, C. Borgnakke; Fundamentals of Classical Thermodynamics; John Wiley & Sons, 4th Ed.; 1996. |
| 2 | J. B. Jones, R. E. Dungan; Engineering Thermodynamics; Prentice Hall of India Pvt. Ltd., New Delhi, Eastern Economy Ed.; 1996. |
| 3 | E. Radhakrishna; Fundamentals of Engineering Thermodynamics; Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Ed.; 2011. |

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| **ENGINEERING MATERIALS SCIENCE AND METALLURGY** | | | | | |
| **Course Code** | **ME340** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **3** | **0** | **0** | **42 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 125 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **0** | **100** | **0** | **0** |

**Course Objectives:**

Provide a fundamental knowledge about common engineering materials - metals, ceramics, polymers and composites and the methods of observing, measuring and interpreting these properties, their usage, which are important in engineering design and manufacture. Give familiarity with various characteristics and structure - property relationships and also thermal processing of metals. Provide proficiency and confidence in making judicial material choices for engineering applications.

**Course Outcomes:**On completing this course students will be able to:

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| --- | --- |
| CO 1 | Describe crystal structures and understand the impacts of defects at the atomic and microstructure scales. |
| CO 2 | Interpret phase diagrams, understand the concepts of solid solution and solubility limits, and be able to predict the development of microstructures and impacts of phase transformations. |
| CO 3 | Understand heat treatment of materials and characterisation of material properties. |
| CO 4 | Understand the choice of an alloy for a particular application. |

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| **UNIT-1** | **11 Hrs** |
| **Crystal Structure:** Unit cell, Space lattices and Crystal structures, Packing efficiency, Miller indices for planes and directions, Linear and planar density.  **Crystal Defects:**Point defects - vacancy, impurities, Schottky and Frenkel defects. Line defects - edge and screw dislocations, Burgers vector, Dislocation motion, Multiplication of dislocations. Surface defects - grain boundaries, twin boundaries, stacking faults.  **Plastic Deformation:** Slip in a perfect lattice, Deformation by slip, Slip systems, Critical resolved shear stress for slip, Deformation by twinning, strain hardening, recovery- recrystallization-grain growth. |  |
| **UNIT-2** | **11 Hrs** |
| **Fracture:** Types of fracture in metals, ductile fracture, theoretical cohesive strength of metals, Griffith theory of brittle fracture, ductile-brittle transition temperature.  **Phase Diagrams:** Solid solutions, Cooling curves, Binary phase diagrams, Gibb’s phase rule, Interpretation of phase diagram, Lever rule.  **Iron-Carbon Phase Diagrams:** Iron - Iron Carbide diagram, Phases, Structures, Invariant reactions in Fe-Fe3C diagram, Critical temperature lines and Development of microstructure during slow cooling, Isothermal Transformation diagram and Continuous Cooling Transformation diagram for eutectoid steel. |  |
| **UNIT-3** | **10 Hrs** |
| **Heat treatment of steels:**Annealing – Full Annealing, Process annealing and spheroidizing anneal, Normalizing, Hardening, Tempering, Hardenability, Jominy End Quench test. Case hardening of steels - Carburizing, Cyaniding, Nitriding, Induction and Flame hardening. Heat treatment of non-ferrous metals & alloys by precipitation hardening.  **Metallography:** Sample preparation for microstructural examination, Construction and working of metallurgical microscope.  **Mechanical Testing of Materials:** Tensile, Torsion, Impact, Hardness, Fatigue, Creep and Formability tests.  **Non Destructive Testing of Materials:** X - Ray and Gamma Radiography, Magnetic particle inspection, Fluorescent penetrant test, Ultrasonic inspection, Eddy current inspection. |  |
| **UNIT -4** | **10 Hrs** |
| **Powder Metallurgy:** Powder manufacture, blending or mixing, compacting, sintering, secondary operations, applications, advantages and limitations.  Composite Materials: Introduction, Classification – Based on matrix & reinforcement, Particle reinforced, Dispersion Strengthened and Fibre Reinforced Composites.  **Alloying of Steels:** Effect of alloying elements, Classification, Properties and Typical Applications of Alloy steels, Tool steels & Stainless steels.  **Cast Irons:** Gray, White, Malleable and Spheroidal Cast Irons**.** |  |

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| **TEXTBOOKS** | |
| 1 | V. Raghavan; Materials Science and Engineering; PHI; Sixth Edition, 2015. |
| 2 | William D. Callister Jr.; Materials Science and Engineering; John Wiley & Sons, New York; Sixth Edition, 2003. |
| **REFERENCES** | |
| 1 | Sydney H. Avner; Introduction to Physical Metallurgy; TMH; Second Edition, 1997. |
| 2 | George E. Dieter; Mechanical Metallurgy; TMH, Third edition, 2017. |
| 3 | R. A. Higgins; Engineering Metallurgy Part I: Applied Physical Metallurgy; Arnold Publishers; Sixth Edition, 1993. |

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| **ENGINEERING METROLOGY AND MACHINE DRAWING** | | | | | |
| **Course Code** | **ME350** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **4** | **0** | **0** | **56 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 125 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **0** | **100** | **0** | **0** |

**Course Objectives:**

To visualize mechanical component and convert it into a drawing.To understand conventional symbols used in machining and mechanical details as per IS.To assemble and disassemble the mechanical parts.

**Course Outcomes:**On completing this course students will be able to:

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| CO 1 | Understand basic principles and standards of engineering measurements |
| CO 2 | Understand the use of limits, fits, tolerances, GD&T in Mechanical engineering |
| CO 3 | Create assembly drawings and freehand sketches of mechanical joints / fasteners. |
| CO 4 | Create disassembly drawings and freehand sketches of permanent joints. |

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| **UNIT-1** | **14 Hrs** |
| **BasicPrinciplesofEngineeringMeasurement:**Introduction to Metrology, Need for Inspection, Objectives of Metrology and Measurements, Process of Measurement, Accuracy and Precision, Calibration of Measuring Instruments, Errors in Measurements, Systematic and Random Errors, Methods of Measurement.  **Standards of Measurement:**Introduction, Standards and their Roles, Systems of Measurement, Material Standard, Wavelength Standard, Line and End Standards of Measurements, their characteristics, advantages and disadvantages.  **Linear Measurement:** Depth gauge, height gauge, Vernier Instruments, Micrometer Instruments, and Slip Gauges: Sizes and Grades, Wringing, building up of slip gauges for required dimension, care of slip gauges.  **Angular Measurement:** Bevel Protractor, Sine Bars, Angle gauges and its combination to build the required angle |  |
| **UNIT-2** | **14 Hrs** |
| **Dial Indicators:** Requirement of good dial indicator, classification, advantages and limitations.  **Comparators:** Classification, need, essential characteristics of a good comparator, classification. Advantages, Limitations and Applications: Mechanical, Optical, Electrical, Electronic, Pneumatic.  **Limits, Fits, and Tolerances:**Introduction, Tolerances, classification of tolerances, clearance, interference and transition Fits, allowance, System of Limits and Fits, Indian Standard limit fit system, Limit gauging, classification of gauges, Taylor’s Principle of Gauge Design, Gauge Tolerance, Wear Allowance, Design of Plug and Snap gauges.  **Geometric Tolerancing:** Introduction, types: form, orientation, positioning and run out, symbolic representation of geometric tolerances, symbols on a standard drawing and their interpretation.  **Metrology of Screw Threads:** Measurement of Screw Thread elements: Major diameter, Minor diameter, measurement of Pitch.  **Metrology of Surface Finish**: Concepts, Terminology, Analysis of Surface traces, surface texture symbols. Tomlinson Surface Meter, Taylor-Hobson Talysurf. |  |
| **UNIT-3** | **14 Hrs** |
| **Preliminaries:** Introduction to machine drawing, conventional representation of machine components, materials, springs & gears.  **Threaded Fasteners & Joints**: Screw thread nomenclature, types of threads, nut, bolt and washer, locking arrangements of nuts, foundation bolts (freehand sketches only)  **Keys, Cotters & Pin Joints:** Keys, cotter joints, socket & spigot joint, sleeve & cotter joints, jib & cotter joint, knuckle joint (freehand sketches only)  **Assembly Drawings with Sectioning and Bill of Materials (only front view):**Footstep bearing, Lathe tool post, screw jack, pipe vice. |  |
| **UNIT-4** | **14 Hrs** |
| **Welded Joints:** Types of welded joints, welding symbols (freehand sketches only).  **Riveted Joints:** Introduction, classification, caulking &fullering for rivets, Pipe joints (freehand sketches only)  **Part or Disassembly Drawings:** Milling Machine Tail stock, crane hook, blow off cock, feed check valve. |  |

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| **TEXTBOOKS** | |
| 1 | R. K. Jain; Engineering Metrology; Khanna Publishers; 21e; 2015. |
| 2 | N. Siddheshwar, P. Kannaiah, V. V. S. Sastry; Machine Drawing; Tata-McGraw Hill. |
| 3 | K. C. John; A text book of Machine Drawing; PHI Learning Pvt. Ltd., New Delhi. |
| **REFERENCES** | |
| 1 | N. V. Raghavendra, L. Krishnamurthy; Engineering Metrology and Measurements; Oxford University Press; 2015. |
| 2 | P. S. Gill; Machine Drawing; SK Kataria& Sons, New Delhi. |
| 3 | N. D. Bhat; Machine Drawing; Charotar Publishing Company. |

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| **ENGINEERING MATERIALS SCIENCE AND METALLURGY LABORATORY** | | | | | |
| **Course Code** | **ME360** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **0** | **0** | **1** | **28 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 75 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **0** | **25** | **0** | **50** | **0** |

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| **LIST OF EXPERIMENTS** |  |
| **Eight experiments** to be conducted from the below given list of experiments.   1. To draw the stress-strain curve and calculate the elastic limit, yield strength, ultimate tensile strength, percentage of elongation, percentage of reduction in area, toughness and resilience of the given metal. 2. To measure the hardness of the given material using Brinell/Rockwell/Vicker’s Hardness testing machine. 3. To measure the impact strength and notch sensitivity of the given metal.  To study the creep behavior and determine the steady state creep rate of the given  specimen 4. To determine the capacity of the material to withstand repeated cyclic stress  through fatigue test. 5. To determine the ductile - brittle transition temperature of the given metal. 6. To determine the formability of the given metal using cupping test. 7. To study the microstructure of (a) mild steel (b) brass (c) cast iron. 8. To detect the presence of cracks/flaws in the given metal piece by magnetic particle  crack detection method. 9. To detect the presence of cracks/flaws in the given metal piece by dye penetrant test. 10. To determine the hardenability of the given specimen using Jominy End Quench test. 11. To study the change of microstructure and property during heat treatment of the  given specimen. 12. To determine the wear constant of the given material using wear testing machine 13. To determine the torsional strength and angle of twist of the given specimen |  |

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| **ENGINEERING METROLOGY AND MACHINE DRAWING LABORATORY** | | | | | |
| **Course Code** | **ME370** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **0** | **0** | **1** | **28hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 75 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **0** | **25** | **0** | **50** | **0** |

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| **LIST OF DRAWING SHEETS** |  |
| Following should be completed and submitted within given deadline.   1. **Two** sheets on assembly and **two** sheets on disassembly to be done. 2. **One** drawing on assembly and disassembly to be done using AutoCAD or any other standard drafting software. 3. Sketch book to comprise of free hand sketches. (Unit 3 and Unit 4)   **(Term work marks allotted for the above = 15)** |  |
| **LIST OF EXPERIMENTS** |  |
| **Five experiments**to be conducted from the below given list of experiments.   1. MeasurementbyUsingVernierCalliper(Dial,DigitalandPlain). 2. MeasurementofdimensionsusingVernierHeightGauge. 3. MeasurementofdimensionsusingMicrometerScrewGuage(DigitalandPlain). 4. Calibration of Vernier Calliper (Dial, Digital, Plain) by using Slip Gauges. 5. Calibration of Micrometer (Digital, Plain) by using Slip Gauges. 6. MeasurementofangleusingSinebar/Sinecenter. 7. Measurement of Angle using BevelProtractor. 8. Measurement of Angle using HeightGauge. 9. UseofDialGaugeasMechanicalComparator. 10. MeasurementofSurfaceRoughnessusingSurfaceRoughnessTester. 11. Measurement of various elements of screw thread using Tool Makers Microscope. 12. MeasurementofScrewthreadparametersusingFloatingCarriageMicrometer. 13. LinearandangularmeasurementusingProfileProjector.   (Term work marks allotted for the above = 15)  The Term Work marks to be awarded based on the assessment of the completed sheets, soft copy of drawing using drafting software, the sketch book and the assessment of the file containing minimum six experiment from the list of experiment given above |  |

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| **TECHNICAL COMMUNICATION** | | | | | |
| **Course Code** | **HM001** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **2** | **0** | **0** | **28 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 75 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **0** | **75** | **0** | **0** | **0** |

**Course Objectives:**

To acquaint the students with basic concepts, theories and barriers to communication. To enhance communication skills by giving adequate exposure in LSRW skills and interpersonal skill. To build multidisciplinary approach towards life tasks and life learning.

**Course Outcomes:**On completing this course students will be able to:

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| CO 1 | Demonstrate precise language skills with suitable vocabulary and apt style. |
| CO 2 | Develop life skills/interpersonal skills to progress professionally |
| CO 3 | Apply traits of suitable candidature for a job/higher education. |
| CO 4 | Deliver formal presentations and effectively implementing the verbal and non-verbal skills. |

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| **UNIT -1** | **7 Hrs** |
| **Communication**  **Oral Communication**  Listening, Speaking, Reading, Writing (LSRW), Conversational Dialogues, Role Play, Barriers to Oral Communication, Effective Oral Communication, Principles of Communication, Dos and Don’ts of Group Discussion  **Global Communication**  Social Media, People Analytics, Models of Culture, Cross-Cultural Communication, Compare Cultures of the World, Impact of Cultural Differences on Managerial Communication, Effective Communicator in a Cross-Cultural setting |  |
| **UNIT -2** | **7 Hrs** |
| **Personality Development**  Social Etiquette, Email Etiquette, Table Etiquette, Telephone Etiquette, SWOC Analysis, Life Coaching, Emotional Intelligence, Leadership, Time Management, Motivation, Goal Setting, Team Work and Collaboration, Critical Thinking and Problem Solving, Professional Attitude, Persuasion, Anxiety and Stress Management, Social Responsibility |  |
| **UNIT -3** | **7 Hrs** |
| **Career Development**  Resume Building, Interviewing Skills, Job Search, Personal Networking and Branding, Personal Finance, Build Professional Portfolio |  |
| **UNIT -4** | **7 Hrs** |
| **Public Speaking**  Methods to overcome anxiety, Build Confidence, Use of Media Aids, Craft an Impactful Speech, Design Impactful Presentations, Effective Presentation Delivery |  |

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| **TEXTBOOKS** | |
| 1 | Meenakshi Raman and Sangeeta Sharma; Technical Communication: Principles and Practice, 3rded; Oxford University Press |
| 2 | Meenakshi Raman, Prakash Singh; Business Communication; 2nd ed.; Oxford University Press |
| 3 | Dr. K. Alex; Soft Skills: Know Yourself and Know The World; 3rded; S. Chand Publishing |
| **REFERENCES** | |
| 1 | Nicky Stanton; Mastering Communication; 5th ed.; Palgrave Master Series; Red Globe Press |
| 2 | Ghosh, B. N.; Managing Soft Skills for Personality Development; Tata McGraw Hill; 2012 |
| 3 | Wallace and Masters; Personal Development for Life and Work;10thedition; Thomson Learning |
| 4 | Lehman, Dufrene, Sinha; BCOM : A South-Asian Perspective with CourseMate; 2ndedition; Cengage Learning |
| 5 | Ashraf Rizvi; Effective Technical Communication; Tata McGraw-Hill; 2005 |
| 6 | MolefiKete Asante, William B. Gudykunst, Bella Mody; Handbook of International and Intercultural Communication; 2nd ed.; Sage Publications |

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| **MATHEMATICS-I& II (BRIDGE COURSE)** | | | | | |
| **Course Code** | **AC390** | | **Credits** | **0** | |
| **Scheme of Instruction**  **Hours/ Week** | **L** | **T** | **P** | **TOTAL** | |
| **2** | **0** | **0** | **28 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 0 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **0** | **0** | **0** | **0** | **0** |

**Course Outline:**

This is an audit course.

This course is compulsory to direct second year/lateral entry students. It is introduced to reduce the knowledge gap in the students.

The syllabus is selected topics from FE110 Mathematics I and FE120 Mathematics II.

The Text books and References are same as shown in FE110 Mathematics I and FE120 Mathematics II.

**SEMESTER IV**

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| **ENERGY CONVERSION** | | | | | |
| **Course Code** | **ME410** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **4** | **1** | **0** | **56 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 150 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **25** | **100** | **0** | **0** |

**Course Objectives:**

To study the air standard and actual engine cycles. Study of SI and CI engine components and processes involved along with engine performance characteristics and emissions. Study of alternate fuels for IC engines.

**Course Outcomes:**On completing this course students will be able to:

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| CO 1 | Identify and explain the working of engine components / systems |
| CO 2 | Understand the working of CI engines characteristics and its parameters |
| CO 3 | Analyse engine performance and emissions |
| CO 4 | Understand the operating parameters and working of reciprocating compressors and steam boilers |

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| **UNIT-1** | **14 Hrs** |
| **Engine Construction and Operation**: Heat engines; Internal and external combustion engines; Classification of I.C. Engines; Cycle of operations in four strokes and two-stroke IC engines and their comparative study;.  **Fuels:**Important qualités of the Engine fuels - (SI & CI engines), Alternate fuels (SI & CI engines)  **Spark Ignition Engines:** Theory of Carburetion, Types of carburetors, Electronic fuel injection system, GDI, MPFI, Combustion in spark Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, Phenomenon of Detonation in SI engines, effect of engine variables on Detonation, . Rating of fuels in SI engines, Additives. |  |
| **UNIT-2** | **14 Hrs** |
| **Compression Ignition Engines:** Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking, rating of fuels in CI engines. Dopes & Additives, Comparison of knocking in SI & CI engines.  **Super Charging/ Turbo-charging:** Introduction, Objectives, Effect on power output and efficiency, Supercharging Systems, Turbo-charging, Characteristics of Supercharged Engines, Method of Super Charging, and Limits of Supercharging. Types of supercharging and turbo charging, relative Merits, Matching of turbocharger. |  |
| **UNIT-3** | **14 Hrs** |
| **Engine Testing and Performance:** Introduction to Indian. Standards for testing of I.C. Engine, Mean effective pressure, indicated power, brake power, friction power, Methods to determine power and efficiencies Variables affecting performance of engine, characteristic curves, heat balance sheet, Methods of improving engine performance (Numericals) & simple numericals on super & turbocharged engines.  **Emission of I.C. Engines:** Air pollution due to IC engine, Engine emissions, Hydrocarbon emissions, (HC) & PPM & Carbon monoxide emissions (CO), oxides of Nitrogen (NOx) Euro norms , Bharat stage norms, Introduction to EDC and IDC , Introduction to carbon credit, Emission control methods for SI and CI engines, Electronic control unit, Cat con, EGR. Modern Trends in I.C. Engines. |  |
| **UNIT -4** | **14 Hrs** |
| **Reciprocating Compressors:** Single stage reciprocating compressor-neglecting clearance. Multistage of compressors. Two stage air compressors. Perfect inter-cooling. Ideal inter cooler pressure. Minimum work, Free air delivered, volumetric efficiency, isothermal and adiabatic efficiency. Effect of clearance volume on F.A.D and volumetric efficiency. Work, power and efficiency calculations.  **Steam Boilers:** Fire tube and Water tube boiler, Low pressure and high pressure boilers, once through boiler, examples, and important features of HP boilers, Mountings and accessories. Layout of a modern HP boiler. Equivalent evaporation of boilers. Boiler performance. Boiler efficiency. |  |

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| **TEXTBOOKS** | |
| 1 | Internal Combustion Engine, V Ganesan - TataMcGraw Hill |
| 2 | Internal Combustion Engine, Mathur and Sharma |
| 3 | Power Plant Engineering, P.K.Nag, McGraw Hill Publications New Delhi. |
| **REFERENCES** | |
| 1 | Internal Combustion Engines, Willard W.Pulkrabek, Pearson Education. |
| 2 | Thermal Engineering, .R.K.Rajput, Laxmi Publications New Delhi. |
| 3 | Power Plant Engineering, Domkundwar& Arora, Dhanpat Rai & Sons, New Delhi. |

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| **MACHINE DESIGN** | | | | | |
| **Course Code** | **ME420** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **4** | **1** | **0** | **56 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 150 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **25** | **100** | **0** | **0** |

**Course Objectives:**

The student will achieve an understanding of the design process in mechanical engineering and will be able to correlate design with manufacturing. Understand and be able to design various types of machine elements.

**Course Outcomes:**On completing this course students will be able to:

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| CO 1 | Analyse the stresses and strains in mechanical components and be able to understand and identify the failure modes in machine components |
| CO 2 | Understand the working of power transmission drives. |
| CO 3 | Analyse shafts and fasteners |
| CO 4 | Choose the parameters that will optimize the design for mechanical springs |

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| **UNIT-1** | **14 Hrs** |
| **Introduction to Design Process:** Process of Machine Design, Design considerations in machine parts, use of standard codes, factor of Safety, preferred numbers and preferred series.  **Static Considerations in Design:** Design of simple parts subjected to direct and combined stresses. Design of cotter joint and knuckle joint. Design of levers viz. hand / foot lever, bell crank lever, lever for safety valve.  Design of curved members with rectangular, circular, trapezoidal and I sections.  **Design for Fatigue:**  Stress concentration, reasons, effects and methods to reduce stress concentration, fluctuating stresses, failure due to fatigue, S-N curve, endurance limit, endurance strength modifying factors, Design for finite and infinite life, Miner’s equation, Soderberg, Goodman, Gerber criteria in designing for alternating stresses. Modified Goodman diagram. Design of components for fatigue under combined stresses. |  |
| **UNIT-2** | **14 Hrs** |
| **Flexible Power Drives:** Classification and comparison of flexible drives.  Belt Drives: Flat belt and V belt drives, open and crossed belt drives, length of open and crossed belt drive, stresses in flat and V-belts, selection of flat and V-belts for industrial applications using Data Book/manufacturer’s catalogue.  Power transmission using Wire ropes (theoretical treatment only), types of chains, Power transmission using Chains (theoretical treatment only)  **Gear Design:** Classification of gears, selection of Gears, Law of Gearing.  Spur Gears:Terminology, Interference, Backlash, Force Analysis, Gear Tooth failures, Beam strength, and Wear Strength of Gear Tooth based on Buckingham’s approach and Spott’s approach, Estimation of module based on beam and wear strength, heat treatment of gears, Gear lubrication. |  |
| **UNIT-3** | **14 Hrs** |
| **Design of Joints:**  Threaded connections: screw fastener classification, Terminology of ISO metric threads, Bolted joint in tension, Eccentrically loaded threaded joints, Eccentric load on circular base, Threaded joints subjected to fatigue loading.  Welded Joints: Stresses in fillet and Butt welds. Strength of Parallel and Transverse fillet weld, Eccentrically loaded welded joints. Weld joints subjected to bending and twisting moments, Welded joints subjected to fatigue.  **Design of Shafts:** Design of shaft based on strength, torsional rigidity and lateral rigidity. Design of shaft based on A.S.M.E. code.  **Design of keys:** Classification of keys, Design of Parallel, Taper Sunk keys, Woodruff key and Splines.  **Design of Couplings:** Classification and objectives of couplings, Design of Flanged Coupling and Flexible Bushed Pin Coupling. |  |
| **UNIT -4** | **14 Hrs** |
| **Springs:** Types, application and material for springs, Design equations for helical compression springs, styles of ends, Design of Helical Compression and Tension Springs, Concentric Helical Springs, helical Torsion Springs, surge in springs.  **Multi-Leaf springs**: Design equations for leaf springs, nipping of leaf springs, Design of Multi Leaf springs. |  |

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| **TEXTBOOKS** |  |
| 1. Design of Machine Elements, Bhandari V. B., Tata McGraw-Hill Education. 2. Mechanical engineering Design, Shigley J. E., McGraw-Hill Publication. |  |
| **REFERENCE BOOKS** |  |
| 1. Hall A.S., Holowenko A.R. and Laughlin H.G, Theory and Problems of Machine Design, Schaum’s Outline Series. 2. C.S.Sharma and KamleshPurohit, Design of Machine Elements, PHI Learning Pvt. Ltd. 3. D.K.Aggarwal&P.C.Sharma, Machine Design, S.K Kataria and Sons 4. Design Data - P.S.G. College of Technology, Coimbatore. 5. K. Mahadevan, K. Balveera Reddy, Design Data Handbook for Mechanical Engineers, CBS Publishers. 6. Design of Machine Elements, Spotts M. F., Shoup T. E., Prentice Hall International. 7. Peter Childs, Mechancial Engineering Design 8. R.L.Norton, Machine Design, Pearson Education.   **Note:** Only Reference Books at No. 4 and 5 to be used as data books in semester examination. These reference books (Data Books) at 4 and 5 above are to be provided by the College Examination Cell. Students should not be allowed to carry their own data books in the examination hall. |  |

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| **FLUID MECHANICS** | | | | | |
| **Course Code** | **ME430** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **3** | **1** | **0** | **42 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 150 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **25** | **100** | **0** | **0** |

**Course Objectives:**

To understand fluids, its properties and fluid statics.To analyze Kinematics and Dynamics of fluid flow.To understand the concept of buoyancy and viscous flow.To study boundary layer concept.

**Course Outcomes:**On completing this course students will be able to:

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| CO 1 | **Understand** the basic concept of fluid flow and properties of fluids |
| CO 2 | **Understand** the principles of fluid statics, kinematics and dynamics |
| CO 3 | **Analyse** fluid flow problems with the application of the momentum and energy equations. Understand concept of buoyancy, viscosity and importance of viscosity in real flows |
| CO 4 | Perform dimensional analysis for problems in fluid mechanics. **Understand** the concept of boundary layer formation. |

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| **UNIT-1** | **11 Hrs** |
| **Properties of Fluids:** Basic concepts and definitions, Classification and properties of fluids, Surface tension and capillarity, Compressibility and bulk modulus.  **Fluid Statics:** Liquid pressure and its types, Pascal’s law, Pressure variation in a static fluid, Measurement of pressure, Manometers (simple), Differential manometers, Mechanical gauges, Pressure at a point in a compressible fluid.  **Hydrostatic Forces on Surfaces:** Total pressure, Center of pressure on vertical submerged surfaces in liquid, Total pressure, Center of pressure on horizontal & inclined submerged surfaces in liquid, Hydrostatic paradox. |  |
| **UNIT-2** | **11 Hrs** |
| **Fluid Kinematics & Dynamics:** Types of fluid flow, Discharge, continuity equation, Continuity equation in 3D, Equations of motion, Euler’s equation, Bernoulli’s equation, Practical application of Bernoulli’s equation, Impulse momentum equation, Kinetic energy and momentum correction factor.  **Flow through Pipes:** Loss of head in pipes, major, minor losses, Darcy’s Weisbach equation, Hydraulic gradient and total energy line, Flow through siphon , Equivalent pipe -series & parallel pipes, Flow through nozzle, Water hammer in pipes. |  |
| **UNIT-3** | **10 Hrs** |
| **Buoyancy**: Buoyancy, Centre of Buoyancy, Conditions of equilibrium of floating & submerged bodies, Meta-centre and Metacentric height.  **Viscous Flow**: Introduction, Reynold’s experiment, Flow of viscous fluid through circular pipe-Hagen Poiseuille formula, Flow of viscous fluid between two parallel plates, Power absorbed in viscous flow: Viscous resistance of journal bearing, Foot-step bearings, Collar bearings, Loss of head due to friction in viscous flow, Movement of piston in dash pot. |  |
| **UNIT -4** | **10 Hrs** |
| **Dimensional Analysis:** Dimensions of physical properties, Dimensional homogeneity, Buckingham’s pi theorem, Raleigh’s method, Important dimensionless numbers.  **Boundary layer:** Laminar and turbulent boundary, Laminar sub layer, Boundary layer thickness, Energy thickness and momentum thickness, Drag force on a flat plate due to boundary layer, Total drag due to laminar and turbulent layers, Boundary layer separation and its control. |  |

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| **TEXTBOOKS** | |
| 1 | R. K. Bansal; A textbook of Fluid Mechanics & Hydraulic machines; Laxmi Publications (p) Ltd; 2012. |
| 2 | D. S. Kumar; Fluid Mechanics & Fluid Power Engineering; S. K. Kataria& sons, New Delhi; 2008. |
| 3 | P. N. Modi, S. M. Seth; Hydraulics & Fluid Mechanics including Hydraulic Machines; Standard Book House, New Delhi; 2009. |
| **REFERENCES** | |
| 1 | Y. A. Cengel, J. M. Cimbala; Fluid Mechanics: Fundamentals & Applications; TMH, New Delhi; 2/e. |
| 2 | R. W. Fox, P. J. Pritchard, A. T. McDonald; Introduction to Fluid Mechanics; Wiley India; 7/e. |

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| **ANALYSIS AND SYNTHESIS OF MECHANISMS** | | | | | |
| **Course Code** | **ME440** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **4** | **0** | **1** | **56 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 150 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **25** | **100** | **0** | **0** |

**Course Objectives:**

Aims at initiating, Mechanical Engineering students, in the area of synthesis and analysis of the mechanisms.To analyse mechanical systems, in general. Familiarize basic concepts of toothed gearing and kinematics of gear trains.

**Course Outcomes:**On completing this course students will be able to:

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| CO 1 | Understand fundamental concepts in the study of mechanisms and analyse the motion of commonly used linkages. |
| CO 2 | Analyse linkages for position, velocity and acceleration using analytical and graphical methods. |
| CO 3 | Synthesize linkages to produce predetermined motion using analytical and graphical methods. |
| CO 4 | Design and analyse cams, gears, and gear trains. |

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| **UNIT-1** | **14 Hrs** |
| **Classification of Mechanisms:** Basic kinematic concepts and definitions, degree of freedom, mobility, Kutzbach’s criterion, Gruebler’s criterion, Grashof’s Law, kinematic inversions of four-bar chain and slider crank chains, limit positions, mechanical advantage, transmission angle.  **Description of some Common Linkages:** Exact and approximate straight-line mechanisms, steering gear mechanisms, Geneva wheel mechanism, ratchet and pawl mechanism, toggle mechanism, pantograph and universal joint.  **Kinematics of Rigid Body:** Mathematical preliminaries on vectors & matrices, Newtonian mechanics: work-energy and impulse-momentum principles. Fixed and moving reference frames, coordinate transformations, displacement, time derivatives, Angular velocity and acceleration, velocity and acceleration analysis using moving reference frame, Chasles theorem. |  |
| **UNIT-2** | **14 Hrs** |
| **Velocity and Acceleration Analysis of Mechanisms:** Displacement, velocity and acceleration analysis of mechanisms having higher and lower pairs, by graphical and analytical methods, instantaneous centre of velocity, Aranhold Kennedy theorem, angular velocity ratio theorem, kinematic analysis by algebraic methods, vector approach, Klein’s construction, Coriolis acceleration. |  |
| **UNIT-3** | **14 Hrs** |
| **Kinematic Synthesis of Planar Mechanisms:** Task of synthesis and it’s classification, synthesis of mechanism for three accuracy points using graphical and analytical techniques, Freudenstein’s equation, Four bar coupler curves, Cognate linkages, Bloch’s synthesis method, Practical consideration in mechanism synthesis.  **Cams:** Different types of Cams and followers and terminology for Cam- follower Mechanisms: follower motions : uniform velocity, uniform acceleration and retardation , SHM and cycloid, their comparison, graphical synthesis of cam profile for a given follower and it’s motion, polynomial cams, synthesis of follower motion from the given follower acceleration variation with cam angle, pressure angle, and size of a cam, radius of curvature of the cam profile with roller follower to avoid undercutting, circular arc cam and tangent cams. |  |
| **UNIT -4** | **14 Hrs** |
| **Gears and Gear Trains:** Introduction, classification of gears, gear terminology, law of gearing, velocity of sliding, forms of teeth, cyclodial profile teeth, involute profile teeth, path of contact, arc of the contact, numbers of pairs of teeth in contact, interference in involutes gears, minimum number of teeth to avoid interference, interference between rack and pinion, under cutting, method of avoiding interference, non- standard gears, comparison of cyclodial and involutes tooth forms.  **Helical Gears:** Terminology, Contact in two helical gears, contact ratio, comparison with spur gears.  **Spiral Gears:** Centre distance, velocity ratio, velocity of sliding, efficiency.  **Worm and worm wheel:** Terminology, application, efficiency.  **Bevel Gears:** Terminology, Tredgold’s approximation.  **Gear Trains:** Analysis of simple, compound and epicyclic gear trains, automobile differential. |  |

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| **ASSIGNMENTS**  Four assignments, one on each unit to be submitted within the given deadline. |  |

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| **TEXTBOOKS** | |
| 1 | S.S. Rattan; Theory of Machines; McGraw-Hill Education (India) Pvt Ltd. |
| 2 | J. S. Rao, R. V. Dukkipati; Mechanism and Machine Theory; Wiley Eastern Limited |
| 3 | Irving H. Shames; Engineering Mechanics; Prentice Hall of India Pvt. Ltd. |
| **REFERENCES** | |
| 1 | Jospeh E. Shigley, John J. Uicker Jr.; Theory of machines and Mechanisms; McGraw Hill International. |
| 2 | Hamilton H. Mabie, F. Charles F. Reinholtz; Mechanism and Dynamics of Machinery; John Wiley & Sons. |
| 3 | George H. Martin; Kinematics and Dynamics of Machines; McGraw-Hill International. |
| 4 | Waldron, Kenneth J., Gary L. Kinzel, and Sunil K. Agrawal. Kinematics, dynamics, and design of machinery. John Wiley & Sons, 2016. |

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| **THERMAL LABORATORY-I** | | | | | |
| **Course Code** | **ME450** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **0** | **0** | **1** | **28 hrs/sem** | |
| **Scheme of Examination**  **TOTAL =100 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **0** | **50** | **0** | **50** | **0** |

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| **LIST OF EXPERIMENTS** |  |
| **Part A: Study of physical systems in terms of constructional details and functions**  1] 2 Stroke and 4 Stroke Engines  2] Carburetor.  3] Ignition system.  4] Fuel injection system.  5] Reciprocating Compressor  6] Boilers  **Part B: Students shall perform at least 5 experiments from the list**  1] Performance Test on Four stroke Petrol Engine  2] Performance Test on Four stroke Diesel Engine  3] Emission Analysis of Petrol Engine  4] Emission/ smoke Analysis of Diesel Engine  5] Performance Test on Reciprocating Compressor  6] Operating/main characteristics of Kaplan Turbine.  7] Operating/main characteristics of Pelton Wheel.  8] Operating/main characteristics of Francis Turbine |  |

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| **FLUID MECHANICS LABORATORY** | | | | | |
| **Course Code** | **ME460** | | **Credits** | **4** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **0** | **0** | **1** | **28 hrs/sem** | |
| **Scheme of Examination**  **TOTAL =100 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **0** | **50** | **0** | **50** | **0** |

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| **LIST OF EXPERIMENTS** |  |
| **Eight experiments** to be conducted from the below given list of experiments.   1. Verification of Bernoulli’s Theorem 2. To determine the coefficient of discharge of a venturimeter 3. To determine the coefficient of discharge of a orifice meter 4. Calibration of a rotameter 5. To determine the coefficient of discharge of a mouthpiece 6. To determine the coefficient of discharge of a V- notch 7. To determine the coefficient of discharge of a Rectangular- notch 8. To calculate friction factor in Helical coil 9. To determine coefficient of friction in pipe set-up 10. To find minor losses in pipes 11. To determine the coefficient of discharge of a flow nozzle 12. Demonstration of Reynold’s Experiment 13. Determination of metacentric height of a ship model 14. Determination of the centre of pressure of a plane surface being subjected to hydrostatic thrust 15. Experimental verification of momentum equation 16. Study of boundary layer velocity profile |  |

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| **ECONOMICS FOR ENGINEERS** | | | | | |
| **Course Code** | **HM003** | | **Credits** | **3** | |
| **Scheme of Instructions**  **(Hours / week)** | **L** | **T** | **P** | **TOTAL** | |
| **3** | **0** | **0** | **42 hrs/sem** | |
| **Scheme of Examination**  **TOTAL = 150 marks** | **IA** | **TW** | **TM** | **P** | **O** |
| **25** | **0** | **100** | **0** | **25** |

**Course Objectives:**

1. To expose students to basic Economic concepts and apply economic reasoning to problems of business.

2. To familiarize the students with the microeconomics principles of economics.

3. To enhance students understanding of macroeconomic issues and problems.

4. To acquaint the students with standard concepts that they are likely to find useful in their profession when employed.

**Course Outcomes:**

On completing this course students will be able to:

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| CO1 | To acquire the skills to apply the basics of economics to Engineering |
| CO2 | To evaluate the economic theories, cost concepts and pricing policies |
| CO3 | To calculate National Income, Inflation and Price Index |
| CO4 | To evaluate the different measures of Economic Growth & Development. |

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| **UNIT 1** |  |
| Central concepts of Economics- Definitions of Economics , Scarcity and Efficiency, Nature of Economics: Positive and normative economics, Microeconomics and Macroeconomics  Basic Elements of Supply and Demand- The Demand Schedule, The Demand Curve, Market Demand , Forces behind the Demand Curve, Shifts in Demand. The Supply Schedule The Supply Curve, Forces behind the Supply Curve , Shifts in Supply. Equilibrium of Supply and Demand, Effect of a Shift in Supply or Demand. Supply and Demand: Elasticity and Applications to major economic issues  **Estimation/Forecasting of Demand:** Meaning, importance, methods – trend, exponential smoothing, regression analysis | **11 Hours** |
| **UNIT 2** |  |
| Microeconomics: Demand & Consumer Behaviour- Choice & Utility Theory. Production and Business Organization, Theory of Production and Marginal Products Basic Concepts, The Nature of the Firm, Big, Small, and Infinitesimal Businesses. Economic Analysis of Costs, Total Cost: Fixed and Variable. Production, Cost Theory, and Decisions of the Firm. Market structures.Perfect and imperfect competition, oligopoly, monopoly. | **11 Hours** |
| **UNIT 3** |  |
| Macroeconomics: Key Concepts of Macroeconomics. Objectives and Instruments of Macroeconomics. Aggregate Supply and Demand.  **National Income Terms:** -Gross Domestic Product: The Yardstick of an Economy’s Performance. Real vs. Nominal GDP. Net Domestic Product, GNP, National Income, Per capita income, Disposable Income, Price Index, Inflation.  Consumption and Investment- Consumption, Income, and Saving, Investment. Determinants of Investment.  Monetary Policy and the Economy .Government Control of the Economy- The Tools of Government Policy | **10 Hours** |
| **UNIT 4** |  |
| Economic Growth and Development: Economic Growth- The Long-Term Significance of Growth, The Four Wheels of Growth. Economic Development- meaning, criteria, measures of development- Per Capita Income, Index of Human Development .  Financial markets- Structure, Participants, functions. Capital market- Instruments, Players, trading - Primary and secondary market - Role of stock exchanges and stock indices. Money market | **10 Hours** |

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| **TEXTBOOKS** | |
| 1 | P.A. Samuelson  & W.D. Nordhaus, Economics, 19th Edition  McGraw  Hill, New York, 1995. |
| 2 | A. Koutsoyiannis, Modern Microeconomics, Macmillan, 1975. |
| 3 | O.P. Khanna , Economics for Engineers,VK Global Publications Private Limited. |
| **REFERENCES** | |
| 1 | Chandra P., Fundamentals of Financial Management, Tata McGraw Hill Education Private Limited, New Delhi |