## Course Structure of

## B. Tech (Mechanical Engineering) programme

## (Batch 2023 Onwards)

### Semester I — First Year

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **BSC-1** | MTL BS101 | Engineering Mathematics-I | 3 | 1 | 0 | 4 |
| 2. | **BSC 2** | PHL BS101 | Engineering Physics | 3 | 0 | 0 | 3 |
| 3. | **BSC 2** | PHP BS101 | Engineering Physics Lab | 0 | 0 | 2 | 1 |
| 4. | **ESC-1** | CSL ES101 | Introduction to 'C' Programming | 3 | 0 | 0 | 3 |
| 5. | **ESC-1** | CSP ES101 | 'C' Programming Lab | 0 | 0 | 2 | 1 |
| 6. | **ESC-2** | ECL ES101 | Basic Electronics | 3 | 0 | 0 | 3 |
| 7. | **ESC-2** | ECP ES101 | Basic Electronics Lab | 0 | 0 | 2 | 1 |
| 8. | **SEC-1** | MEP SE101 | Engineering Workshop | 1 | 0 | 2 | 2 |
| 9. | **AEC-1/VAC1** | | Ability Enhancement/ Value Added course | x | 0 | x | 2 |
| | | | **Total Credits** | **13** | **1** | **8** | **20** |

### Semester II — First Year

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **BSC 3** | MTL BS102 | Engineering Mathematics II | 3 | 1 | 0 | 4 |
| 2. | **BSC 4** | BTL BS 102 | Applied Chemistry | 3 | 0 | 0 | 3 |
| 3. | **BSC 4** | BTP BS 102 | Applied Chemistry Lab | 0 | 0 | 2 | 1 |
| 4. | **DCC-1** | MEL DC101 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| 5. | **DCC-2** | MEL DC102 | Materials Science and Engineering | 3 | 0 | 0 | 3 |
| 6. | **DCC-2** | MEP DC102 | Materials Science and Engineering Lab | 0 | 0 | 2 | 1 |
| 7. | **SEC-2** | MEP SE102 | Engineering Graphics with CAD | 1 | 0 | 2 | 2 |
| 8. | **AEC-2** | XXX AEXX | Ability Enhancement Course | 2 | 0 | 0 | 2 |
| 9. | **VAC-2** | XXX VAXX | Value Added course | 2 | 0 | 0 | 2 |
| 10. | **MAC-1** | XXL MCXX | Universal Human Values-II | 2 | 0 | 0 | NC |
| | | | **Total Credits** | **19** | **2** | **6** | **22** |

**Semester III** **Second Year**

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **BSC-5** | MEL BS201 | Thermodynamics | 3 | 0 | 0 | 3 |
| 2. | **ESC-3** | CSL ES102 | Programming using Python | 3 | 0 | 0 | 3 |
| 3. | **ESC-3** | CSP ES102 | Python Programming Lab | 0 | 0 | 2 | 1 |
| 4. | **DCC-3** | MEL DC201 | Kinematics of Machines | 3 | 1 | 0 | 4 |
| 5. | **DCC-4** | MEL DC203 | Fluid Mechanics | 3 | 0 | 0 | 3 |
| 6. | **DCC-4** | MEP DC203 | Fluid Mechanics Lab | 0 | 0 | 2 | 1 |
| 7. | **DCC-5** | MEL DC205 | Strength of Materials – I | 3 | 0 | 0 | 3 |
| 8. | **DCC-5** | MEP DC205 | Strength of Materials Lab | 0 | 0 | 2 | 1 |
| 9. | **SEC-3** | MEL SE203 | Machine Drawing with CAD | 1 | 0 | 2 | 2 |
| 11. | **VAC-3** | XXX VAXX | Value added course | x | 0 | x | 2 |
| 12. | **PR** | MEIPR201 | Summer Internship – I | 0 | 0 | 2 | 1 |
| | | | **Total Credits** | **16** | **1** | **10** | **24** |

**Semester IV** **Second Year**

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **DCC-6** | MEL DC202 | Thermal Engineering | 3 | 0 | 0 | 3 |
| 2. | **DCC-6** | MEP DC202 | Thermal Engineering Lab | 0 | 0 | 2 | 1 |
| 3. | **DCC-7** | MEL DC204 | Fluid Machines | 3 | 0 | 0 | 3 |
| 4. | **DCC-7** | MEP DC204 | Fluid Machines Lab | 0 | 0 | 2 | 1 |
| 5. | **DCC-8** | MEL DC206 | Manufacturing Processes | 3 | 0 | 0 | 3 |
| 6. | **DCC-8** | MEP DC206 | Manufacturing Processes Lab | 0 | 0 | 2 | 1 |
| 7. | **DCC-9** | MEL DC208 | Strength of Materials – II | 3 | 1 | 0 | 4 |
| 8. | **DCC-10** | MEL DC210 | Dynamics of Machines | 3 | 0 | 0 | 3 |
| 9. | **DCC-10** | MEP DC210 | Dynamics of Machines Lab | 0 | 0 | 2 | 1 |
| 11. | **VAC-4** | XXX VA XX | Value Added Course | X | X | X | 2 |
| 12. | **MAC-2** | XXL MC2XX | Environmental Studies | 2 | 0 | 0 | NC |
| | | | **Total Credits** | **17** | **1** | **8** | **22** |

**Semester V** **Third Year**

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **DCC-11** | MEL DC301 | Machine Design | 3 | 1 | 0 | 4 |
| 2. | **DCC-12** | MEL DC303 | CAD/CAM | 3 | 0 | 0 | 3 |
| 3. | **DCC-12** | MEP DC303 | CAD/CAM Lab | 0 | 0 | 2 | 1 |
| 4. | **DCC-13** | MEL DC305 | Artificial Intelligence and Machine Learning | 3 | 1 | 0 | 4 |
| 5. | **DEC-1** | MEL DE 3XX | Departmental Elective – I | 3 | 1 | 0 | 4 |
| 6. | **DEC-II /GEC-1** | XXL GE 3XX | Departmental Elective II/ Generic Elective – I | 3 | 1 | 0 | 4 |
| 7. | **PR** | MEI PR301 | Summer Internship-II | 0 | 0 | 2 | 1 |
| 8. | **DCC** | MED PD 301 | Project Work -1 | 0 | 0 | 4 | 2 |
| | | | **Total Credits** | **15** | **4** | **8** | **23** |

**Semester VI** **Third Year**

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **DCC-14** | MEL DC302 | Manufacturing Processes II | 3 | 0 | 0 | 3 |
| 2. | **DCC-14** | MEP DC302 | Manufacturing Processes II Lab | 0 | 0 | 2 | 1 |
| 3. | **DCC-15** | MEL DC304 | Heat and Mass Transfer | 3 | 0 | 0 | 3 |
| 4. | **DCC-15** | MEP DC304 | Heat and Mass Transfer Lab | 0 | 0 | 2 | 1 |
| 5. | **DEC-3** | MEL DE3XX | Departmental Elective-III | 3 | 1 | 0 | 4 |
| 6. | **DEC-4/GEC -2** | XXL GE3XX | Departmental Elective – IV/Generic Elective – II | 3 | 1 | 0 | 4 |
| 7. | **AEC** | | Management Course/ Entrepreneurship/Economy | 3 | 0 | 0 | 3 |
| 8. | **DCC** | MED PR 302 | Project Work- II | 0 | 0 | 4 | 2 |
| 9. | **MAC-3** | | | 2 | 0 | 0 | NC |
| | | | **Total Credits** | **17** | **2** | **8** | **21** |

**Semester VII** **Fourth Year**

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **DCC-16** | MEL DC401 | Industrial Engineering | 3 | 1 | 0 | 4 |
| 2. | **DEC-5** | MEL DE4XX | Departmental Elective – V | 3 | 1 | 0 | 4 |
| 3. | **DEC-6/GEC-3** | XXL GE4XX | Departmental Elective – VI/ Generic Elective – III | 3 | 1 | 0 | 4 |
| 4. | **DCC** | MED PR401 | Minor Project | 0 | 0 | 8 | 4 |
| 5. | **PR** | MEI PR401 | Summer Internship –III | 0 | 0 | 4 | 2 |
| | | | **Total Credits** | **9** | **3** | **12** | **18** |

**Semester VIII** **Fourth Year**

| S. No. | Course Category | Course Code | Course Title | L | T | S/P | Credit |
|---|---|---|---|---|---|---|---|
| 1. | **PR** | MED PR402 | (Major Project) / Internship | 0 | 0 | 14 | 7 |
| 2. | **GEC-4** | XXL GE4XX | Generic Elective-IV | 3 | 1 | 0 | 4 |
| | | | Total Credits | **3** | **1** | **14** | **10** |
| | | | **Total Credits (B. Tech)** | | | | **160** |

**LIST OF SKILL ENHANCEMENT COURSES**

| Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|
| MEM SE101 | Engineering Workshop | 1-0-2 | 2 |
| MEM SE102 | Engineering Graphics with CAD | 1-0-2 | 2 |
| MEM SE103 | 3D Printing Technology | 1-0-2 | 2 |

**LIST OF ABILITY ENHANCEMENT COURSES**

| Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|
| MEL AE101 | Presentation Skills and Technical Writing | 1-0-2 | 2 |

## LIST OF VALUE ADDED COURSES

| Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|
| MEL VA101 | Introduction to Sustainability | 2-0-0 | 2 |
| MEL VA102 | Introduction to Product Design | 2-0-0 | 2 |
| MEL VA103 | MATLAB for Engineers | 2-0-0 | 2 |

## List Of Departmental/School Core Electives (DES)

**Departmental Elective –I**

| S. No. | Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|---|
| 1 | MEL DE301 | Product Design and Development | 3-1-0 | 4 |
| 2 | MEL DE303 | Industrial Robotics | 3-1-0 | 4 |
| 3 | MEL DE305 | Introduction to Bio Mechanics | 3-1-0 | 4 |
| 4 | MEL DE307 | Energy and its Resources | 3-1-0 | 4 |
| 5 | MEL DE309 | Hydrogen and Fuel Cell | 3-1-0 | 4 |
| 6 | MEL DE311 | Tribology | 3-1-0 | 4 |

**Departmental Elective –II**

| S. No. | Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|---|
| 1 | MEL DE313 | Materials and Characterization Techniques | 3-1-0 | 4 |
| 2 | MEL DE315 | Mechatronics | 3-0-2 | 4 |
| 3 | MEL DE317 | Introduction to Biomedical Engineering | 3-1-0 | 4 |
| 4 | MEL DE319 | Energy Storage for Renewables | 3-1-0 | 4 |
| 5 | MEL DE321 | Sustainable Energy Engineering | 3-1-0 | 4 |
| 6 | MEL DE323 | Mechanical Vibrations | 3-0-2 | 4 |

**Departmental Elective –III**

| S. No. | Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|---|
| 1 | MEL DE302 | Biomaterials (*) | 3-1-0 | 4 |
| 2 | MEL DE304 | Mechanics of Robots | 3-1-0 | 4 |
| 3 | MEL DE306 | Solar Thermal Power Engineering | 3-1-0 | 4 |
| 4 | MEL DE308 | Gas Dynamics and Jet Propulsion | 3-1-0 | 4 |
| 5 | MEL DE310 | IC Engines | 3-0-2 | 4 |
| 6 | MEL DE312 | Control Systems | 3-1-0 | 4 |
| 7 | MEL DE314 | Metrology and Measurements | 3-0-2 | 4 |

(*) being considered in two Honors programme

**Departmental Elective –IV**

| S. No. | Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|---|
| 1 | MEL DE316 | Finite Element Analysis (*) | 3-0-2 | 4 |
| 2 | MEL DE318 | Computer Integrated Manufacturing System | 3-1-0 | 4 |
| 3 | MEL DE320 | Power Plant Engineering | 3-1-0 | 4 |
| 4 | MEL DE322 | Experimental Stress Analysis | 3-1-0 | 4 |
| 5 | MEL DE324 | Automobile Engineering | 3-0-2 | 4 |

(*) being considered in two Honors programme

**Departmental Elective –V**

| S. No. | Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|---|
| 1 | MEL DE401 | Computational Fluid Flow and Heat Transfer | 3-1-0 | 4 |
| 2 | MEL DE403 | Electric Vehicles | 3-0-2 | 4 |
| 3 | MEL DE405 | Refrigeration and Air Conditioning | 3-0-2 | 4 |
| 4 | MEL DE407 | Fracture Mechanics | 3-1-0 | 4 |
| 5 | MEL DE409 | Operations Research | 3-1-0 | 4 |

**Departmental Elective –VI**

| S. No. | Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|---|
| 1 | MEL DE411 | Modeling and Simulation of Manufacturing System | 3-1-0 | 4 |
| 2 | MEL DE412 | Control Systems | 3-1-0 | 4 |
| 3 | MEL DE413 | Work Study and Ergonomics | 3-1-0 | 4 |
| 4 | MEL DE414 | Micro and Nano Machining | 3-1-0 | 4 |
| 5 | MEL DE415 | Quality Management | 3-1-0 | 4 |

**LIST OF GENERIC ELECTIVES**

| S. No. | Course Code | Course Title | L-T-P | Credits |
|---|---|---|---|---|
| 1 | MEL DE301 | Product Design and Development | 3-1-0 | 4 |
| 2 | MEL DE305 | Introduction to Bio Mechanics | 3-1-0 | 4 |
| 3 | MEL DE321 | Sustainable Energy Engineering | 3-1-0 | 4 |
| 4 | MEL DE313 | Materials and Characterization Techniques | 3-1-0 | 4 |
| 5 | MEL DE413 | Work Study and Ergonomics | 3-1-0 | 4 |
| 6 | MEL DE307 | Energy and its Resources | 3-1-0 | 4 |
| 7 | MEL DE302 | Biomaterials | 3-1-0 | 4 |
| 8 | MEL DE409 | Operations Research | 3-1-0 | 4 |
| 9 | MEL DE320 | Power Plant Engineering | 3-1-0 | 4 |
| 10 | MEL DE 326 | 3D Printing: Introductions and Processes | 3-1-0 | 4 |
| 11 | MEL DE415 | Quality Management | 3-1-0 | 4 |
| 12 | MEM DE403 | Electric Vehicles | 3-0-2 | 4 |
| 13 | MEL DE303 | Industrial Robotics | 3-1-0 | 4 |
| 14 | MEM DE315 | Mechatronics | 3-1-0 | 4 |
| 15 | MEL DE304 | Mechanics of Robots | 3-1-0 | 4 |
| 16 | MEL DE318 | Computer Integrated Manufacturing System | 3-1-0 | 4 |
| 17 | MEL DE317 | Introduction to Biomedical Engineering | 3-1-0 | 4 |
| 18 | MEM DE316 | Finite Element Analysis | 3-0-2 | 4 |

## Semester - I

**Course Code** : **BSC-MTL1025**
**Course Title** : **Engineering Mathematics-1**
**L-T-P/S=Credits** : **3-1-0 =4**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Differential Calculus:** Partial differentiation, asymptotes, concavity, convexity, point of inflexion, curvature, radius of curvature, curve tracing, envelopes and evolutes, change of variables, Jacobian, expansion of functions of several variables, chain rule, mean value theorem, Taylor series with remainder term, maxima & minima, saddle point. | **05** |
| 2 | **Integral Calculus:** Fundamental theorem of Integral calculus, reduction formulae, properties of definite integral, applications to length, area, volume, surface of revolution. Moments, centre of gravity, improper integrals, β-γ functions. | **05** |
| 3 | **Matrices:** Elementary row and column transformation, linear dependence, rank of a matrix, consistency of system of linear equations, solution of linear system of equations, characteristic equations, Cayley Hamilton theorem, Eigenvalues and Eigenvectors, diagonalization, complex matrices. | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | E. Kreysig, Advanced Engineering Mathematics, Wiley 10th edition. | 2011 |
| 2 | A . K. Gupta, Engineering Mathematics, Macmillan 7$^{th}$ edition. | 2013 |
| 3 | McQuarri Macmillan, Mathematical Methods by Scientists & Engineers, 1$^{st}$ edition. | 2003 |
| 4 | Shanti Narayan, Differential Calculus, S Chand; 30$^{th}$Revised edition. | 2005 |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Introduce the basic concept of differential calculus to understand the different subjects of engineering as well as basic sciences. | CO1 |
| 2 | Enable the students to develop the concept of partial differentiation to understand their applications in engineering. | CO2 |
| 3 | Understand the fundamentals of Integral calculus to understand their applications to length, area, volume, surface of revolution, moments and centre of gravity. | CO3 |
| 4 | Understand the improper integrals and Beta and Gamma functions and their applications. | CO4 |
| 5 | Understand the idea of Linear Algebra which is useful to all branches of engineering. | CO5 |

**Course Code** : **BSC-PHL1012**
**Course Title** : **Engineering Physics**
**L-T-P/S=Credits** : **3-0-0 =4**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit I:** Force and electric field due to continuous charge distribution, Field lines–Flux–Gauss's Law (differential and integral forms) and its applications, Electric potential, Work done in assembling a charge distribution. | **05** |
| 2 | **Unit II:** Force Law–line current, surface current and volume current densities (Equation of Continuity), Biot-Savart's law, Properties of B, Magnetic flux–Div B, Curl B, Magnetic vector potential A, Ampere's law (differential and integral forms), Faraday's laws of electromagnetic induction, displacement current, Modified Ampere's law, Four Maxwell's equations in differential and integral forms. | **07** |
| 3 | **Unit III:** Electromagnetic Spectrum, Brief introduction to black body radiation, Photo-electric Effect and Compton Effect, Wave particle duality (de–Broglie waves), Davisson-Germer Experiment, Concept of wave function and its physical significance, Phase and Group velocities, Uncertainty Principle. | **05** |
| 4 | **Unit IV:** Bohr Theory of atom (with finite and infinite nuclear mass), Derivation of time dependent and time independent Schrödinger wave equations, Expectation values and operators (momentum, energy and angular momentum operators) and commutators, Particle in a box of infinite height (One dimensional). | **06** |
| 5 | **Unit V:** Free electron theory–Free electron gas, Energy levels and density of states in one dimension, Band theory of solids, Classification of metals, semiconductors and insulators on the basis of band theory. | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Introduction to Electrodynamics, D. J. Griffiths, Pearson. | |
| 2 | Concepts of Modern Physics, Beiser, Tata McGraw Hills | |
| 3 | Introduction to Solid State Physics, Charles Kittel, Wiley | |
| **Reference Books** | | |
| 1 | Electromagnetics, B. B. Laud, New Age International Publisher. | |
| 2 | Introduction to Solid State Physics, Charles Kittel, Wiley | |
| 3 | Solid State Physics, Puri and Babbar, S. Chand. | 2010 |
| 4 | Perspective of Quantum Mechanics, S.P. Kuila, NCBA. | 2013 |
| 5 | Fundamentals of Physics, Resnick Halliday, Wiley. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Know the vocabulary and concepts of Physics as it applies to: Electricity and Magnetism and Modern Physics. | CO1 |
| 2 | Develop the mathematical description of these concepts and principles to build up problem solving skills in Electrodynamics and Modern Physics. | CO2 |
| 3 | Gain confidence to develop methods in Quantum Mechanics to understand Physics problems in real-life situations to benefit their future career. | CO3 |
| 4 | Apply Modern Physics concepts for understanding problems related to free electron theory and band theory of solids. | CO4 |

**Course Code** : **BSC-PHP1012**
**Course Title** : **Engineering Physics Lab**
**L-T-P/S=Credits** : **0-0-2 =1**
**Course Category** : **Engineering Science Course**
**Pre-requisite Courses (if any)** :
**Equal Course Code (if any)** :
**Equivalent Course Code (if any)** :

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | To study the measuring instruments (Vernier Calipers, Screw Gauge & Spherometer) |
| 2 | To find the angle of the prism by the rotating telescope method. |
| 3 | To find the refractive index of the material of a given prism using a spectrometer. |
| 4 | To determine the refractive index of the given liquid (water) using a hollow prism and spectrometer. |
| 5 | To study Newton's interference rings and to determine the wavelength of sodium light. |
| 6 | To determine the wavelength of sodium light using a plane diffraction grating. |
| 7 | To determine the frequency of A.C. mains with a sonometer using non- magnetic wire. |
| 8 | To draw the characteristic curves of a semiconductor diode (Si or Ge). |
| 9 | To study the V-I characteristics of a Zener diode. |
| 10 | To study the performance of a half-wave, full-wave & bridge type full-wave rectifier (without filters). |
| 11 | To verify Stefan's law by estimating the temperature of a torch bulb filament from resistance measurement. |
| 12 | To study the Hall-effect and to calculate the Hall coefficient and charge carrier Concentration of a given sample. |
| 13 | To study the dependence of refractive index of the material of the prism on the wavelength of light; and hence (1) to determine the dispersive power of the material of prism; (2) verify the Cauchy relationship $\mu = a + b/\lambda^2$, and estimate the values of a & b (3) plot a graph of $d\mu/d\lambda$ versus $\lambda$. |
| 14 | To determine the band gap by measuring the resistance of a thermistor at different temperatures. |
| 15 | To determine the energy band gap of a semiconductor diode (Ge) using Four probe method. |
| 16 | To study the wavelength of the He-Ne laser. |

**Course Code** : **ESC-CSL1022**
**Course Title** : **Introduction to 'C' Programming**
**L-T-P/S=Credits** : **3-0-2 =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Introduction:** Concept of problem solving, Problem definition, Program design, Techniques of Problem Solving (Flowcharting, algorithms, pseudo code), Structured programming concepts | **04** |
| 2 | **Fundamentals:** C character set, Tokens, identifiers and keywords, constants and variables, Data types, Data Type Modifiers Structure of a C Program, , Types of Statements: declarations, arithmetic statements and arithmetic operations, , Operators: Arithmetic, relational and equality, logical, assignment and compound assignment, Operators classification based on number of operands: Unary, Binary and Ternary (conditional, unary operations), operator's precedence & associativity, library functions, single character input and output, entering and writing data. | **05** |
| 3 | **Control Statements:** Statement and blocks, Decision making structures: if else and its types, Looping structures: while, for, do while, Case control structures: switch, break and continue statements, nested control structures. | **04** |
| 4 | **Arrays:** Definition, types, initialization, processing an array, 2 Dimensional Arrays, Sorting, Searching, Copy, Insertion, Deletion of elements in array. | **03** |
| 5 | **Functions and pointers:** Functions definition, prototype, passing parameters, recursion, pointers, pointers and arrays, pointers and Functions, | **04** |
| 6 | **String:** Operations on String, built in functions, string and functions | **02** |
| 7 | **User defined data types and Additional Features of C:** Structures, Array of Structures, Array within Structures, Structures within Structures, Union, Enumerations, Pre-processor Directives | **03** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Gottfried, Byron S., "Programming with C", Tata McGraw Hill | |
| 2 | Balagurusamy, E., "ANSI C", Tata McGraw-Hill | |
| 3 | YashwantKanetker, "Let us C", BPB | |
| 4 | C, The Complete Reference, Scholdt, TMH | |
| 5 | Programming with C, S. Kaicher, Macmillan | |
| 6 | For Yourself, Asian Inst. of Tech AIT | |
| 7 | Structured Programming Approach Using C, B. Forouzen, Thomas Learning | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Knowledge and understanding of programming. | CO1 |
| 2 | Ability to write simple programs in C language by using basic control structures (conditional statements, loops, switches, branching, etc.). | CO2 |
| 3 | Understanding the concept of programming using functions, arrays, strings, pointers and structures, and implementing the various operations on them. | CO3 |
| 4 | Ability to create a programmable model for a problem given. | CO4 |

**Course Code** : **CSP-ES101**
**Course Title** : **'C' Programming Lab**
**L-T-P/S=Credits** : **0-0-2 =1**
**Course Category** :
**Pre-requisite Courses (if any)** :
**Equal Course Code (if any)** :
**Equivalent Course Code (if any)** :

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | Write a program to know the number of bytes of data type contains |
| 2 | Write a program to display the ASCII code of a variable on the screen |
| 3 | Write a program to find the sum of digits of a 4 digit number |
| 4 | Write a program to reverse a 4 digit number |
| 5 | Write a program to swap the values of two variables with/without using third variable |
| 6 | Write a program to display if a number is even or odd |
| 7 | Write a program to display that a person is eligible for voting |
| 8 | Write a program to display greatest among two/ three numbers |
| 9 | Write a program to read number between 1-7 & display corresponding day of week |
| 10 | Write a program to read marks of five subjects and compute percentage and display grade of students based on percentage |
| 11 | Write a program to check whether the year entered is leap year or not |
| 12 | Write a program to print the relation between 2 numbers as equal to, less than or greater than |
| 13 | Write a program to read lower case character and display it in upper case |
| 14 | Write a program to convert Celsius into Fahrenheit |
| 15 | Write a program to swap the values to two variables with the help of temporary variable |
| 16 | Write a program to make a calculator |
| 17 | Write a program to print 1 to 10 in ascending and descending order on screen |
| 18 | Write a program to print sum of all even/ odd numbers between 1 to n |
| 19 | Write a program to print multiplication table of n |
| 20 | Write a program to find factorial of a number |
| 21 | Write a program to find sum of all numbers between m to n |
| 22 | Write a program to read a number and print each digit on separate line |
| 23 | Write a program to find the sum of digits of a number |
| 24 | Write a program to reverse a number |
| 25 | Write a program to find if the number is Palindrome or not |
| 26 | Write a program to read +ve numbers from user till user enters 0 & display for each number whether it is even or odd |
| 27 | Write a program to read character from user till user enters special character and display count of vowels and digits |
| 28 | Write a program to print all leap years between year m to n |
| 29 | Write a program to read a number and find if it is an Armstrong number or not |
| 30 | Write a program to print all prime number between n to m |
| 31 | Write a program using a switch case to read one number and perform 1. Sum of digit 2. Reverse of number 3. Number is palindrome or not |
| 32 | Write a program using switch case to read operator and perform (+, -, /, *) operators of operands |
| 33 | Write a program to sort an array of type integer |
| 34 | Write a program to reverse an array element in the array |
| 35 | Write a program to check if the array is palindrome or not |
| 36 | Write a program to insert an element in sorted array at its right place |
| 37 | Write a program to delete all the duplicate numbers from the array |
| 38 | Write a program to read temperature recorded for the month of September. Display the highest and lowest temperature recorded |
| 39 | Write a program to read total marks of 90 students. Find the average marks scored by the class. Display the number of students having marks below average and total number of students marks equal to or above average. |
| 40 | Write a program to read n numbers in an array. Display the count of total –ve numbers, +ve numbers and total zero. Your program must derive m which should be added to all –ve numbers so as they are converted to either zero or +ve number. |
| 41 | Write a program to sum the two arrays into another array. |
| 42 | Write a program to add two matrix using multi-dimensional arrays |
| 43 | Write a program to multiply to matrix using multi-dimensional arrays |
| 44 | Write a program to find transpose of a matrix |
| 45 | Write a program to find the length of a string |
| 46 | Write a program to find the total number of vowels in the string |
| 47 | Write a program to find the number of vowels, consonants, digits and white space in string using Switch - case |

| | |
|---|---|
| 48 | Write a program to concatenate two strings |
| 49 | Write a program to find the total number of words in a sentence |
| 50 | Write a program to reverse a sentence |
| 51 | Write a program to remove all characters in a string except alphabet |
| 52 | Write a program to sort elements in different orders in string |
| 53 | Write a program to insert a character in a string |
| 54 | Write a program to delete a character in a string |
| 55 | Write a program to insert a word in a string |
| 56 | Write a program to search a word in a string |
| 57 | Write a program to delete a word in a string |
| 58 | Write a program to find the length of each string in a 2-dimensional array |
| 59 | Write a program to find sort each string in a 2-dimensional array |
| 60 | Write a program to display prime numbers between intervals using function |
| 61 | Write a program to check prime or Armstrong number using user-defined function |
| 62 | Write a program to check whether a number can be expressed as sum of two prime numbers using function |
| 63 | Write a program to find the sum of n natural numbers using function |
| 64 | Write a program to calculate factorial of a number using function |
| 65 | Write a program to reverse a sentence using function |
| 66 | Write a program to calculate power of a number using function |
| 67 | Write a program to convert binary number to decimal and vice-versa using function |
| 68 | Write a program to store information (name, roll and marks) of student using structure |
| 69 | Write a program to add two distances (in inch-feet) system using structure |
| 70 | Write a program to add two complex numbers by passing structure to a function |
| 71 | Write a program to calculate between two time period using structures and functions |
| 72 | Write a program to store information of 10 students using structure and display the roll no, name and total marks of each student structures and functions |
| 73 | Write a program to swap numbers of an array using call by reference |
| 74 | Write a program to find largest number in an array using function |
| 75 | Write a program to multiply two matrices by passing matrix to function |

**Course Code** : **ESC-ECL1010**
**Course Title** : **Basic Electronics**
**L-T-P/S=Credits** : **3-0-0 =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit I:** Introduction: Semiconductor Classification, Semiconductor bonds, Energy band description, Semiconductor types, Hall effect. | **04** |
| 2 | **Unit II:** Diodes: P-N junction-I/V characteristics, diode equivalent circuits, semiconductor diodes, rectifiers-(efficiency, ripple factor),filters, clipers, clampers. | **04** |
| 3 | **Unit III:** Transistors: BJT construction, characteristics (cb,ce,cc), load line. BJT biasing. FET, JFET, MOSFET (Depletion and enhancement), FET biasing. | **03** |
| 4 | **Unit IV:** Transistor Modeling: BJT small signal model, hybrid equivalent model, FET small signal model. | **03** |
| 5 | **Unit V:** Amplifiers: Single stage amplifiers, voltage gain, effect of frequency on Gain, multistage amplifier. | **02** |
| 6 | **Unit VI:** Other Semi-conductor devices: SCR'S, Diacs, triacs, and other thyristors, basic theory of operation, characteristics, Theory and operation of UJT. | **02** |
| 7 | **Unit VII:** Oscillators: Feedback BH criteria, oscillator types, sinusoidal oscillator, Hartley oscillator, Collpitts Oscillator, Phase shift,Wein bridge oscillator, crystal oscillator. | **04** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Basic Electronics: Devices, Circuits & IT Fundamentals, Kal, PHI | |
| 2 | Basic Electronics for Scientists | |
| 3 | Electronic Devices & Circuits: An Introduction, Mottershead, | |
| 4 | Electronic Devices & Circuits, Boylestad, Nashelky, PHI | |
| 5 | Semiconductor Devices, Nandita Dass, PHI | |
| 6 | Electronic Devices & Circuits, Milman & Halkias | |
| 7 | Electronic Devices & Circuits, Theodore Bogart, Jr | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | To learn basic concepts of Semiconductor Devices | CO1 |
| 2 | Able to understand and use BJT and MOS Devices. | CO2 |
| 3 | Learn and able to apply small signal BJT and FET analysis. | CO3 |
| 4 | To analyse and design the rectifiers and amplifiers. | CO4 |
| 5 | Able to understand advanced semiconductor devices and oscillators. | CO5 |

**Course Code** : **ESC-ECP1010**
**Course Title** : **Basic Electronics Lab**
**L-T-P/S=Credits** : **0-0-2 =1**
**Course Category** : **Engineering Science Course**
**Pre-requisite Courses (if any)** :
**Equal Course Code (if any)** :
**Equivalent Course Code (if any)** :

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | To study the front panel control of Multimeter. |
| 2 | To study the front panel control of DC Multiple Power Supply. |
| 3 | To study the front panel control of Cathode Ray Oscilloscope (CRO). |
| 4 | To study the front panel control of Function Generator. |
| 5 | To determine and plot the operating characteristics of a PN junction diode. |
| 6 | To study the characteristics of Zener Diode and its application as voltage regulator. |
| 7 | To study the input / output waveforms of a Half-wave rectifier using diodes and find out its ripple factor and efficiency. |
| 8 | To study the input / output waveform of Full-wave Bridge rectifiers using diodes and find out its ripple factor and efficiency. |
| 9 | To study different Clipper circuits using PN junction diodes for both positive and negative configurations. |
| 10 | To study different Clamper circuits using PN junction diodes. |
| 11 | To plot and determine the characteristics of common-emitter configuration of a transistor. |
| 12 | To plot and determine the characteristics of common-base configuration of a transistor. |

**Course Code** : **SEC-MEP SE101**
**Course Title** : **Engineering Workshop**
**L-T-P/S=Credits** : **1-0-2 =2**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit I:**<br>**Basic Measurements:**<br>Measuring units, Familiarization with meter scale, Vernier calliper, Screw gauge, S.W.G, Height gauge and their utility. Measuring the dimensions of a thin wire, thickness of metal sheet, cylindrical objects etc. | **04** |
| 2 | **Unit II:**<br>**Mechanical Skill-I:**<br>Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, smithy, carpentry and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. | **04** |
| 3 | **Unit III:**<br>**Mechanical Skill-II:**<br>Cutting tools, lubricating oils, Cutting of a metal sheet, Drilling of holes of different diameter in metal sheet and wooden block, Use of bench vice, shearing machine, bending machine and tools for fitting. | **03** |
| 4 | **Unit IV:**<br>**Mechanical Skill-III:**<br>Concept of machining processes, introduction to common machine tools like lathe, shaper, drilling, milling machine. Cutting tool signatures, machines specifications etc. | **03** |
| 5 | **Unit V:**<br>**Introduction to Prime Movers:** | **02** |

| | | |
|---|---|---|
| | Mechanism, gear system Fixing of gears. Lever mechanism, Lifting of heavy weight using lever. Braking systems, pulleys mechanism. | |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Reference Books** | | |
| 1 | A text book of workshop Technology – S.K Garg - University Science Press. | |
| 2 | A text book of workshop Technology – Khurmi and Gupta S. - Chand and Company. | |
| 3 | Mechanical workshop practice, K.C. John, PHI Learning Pvt. Ltd. | 2010 |
| 4 | Workshop Technology–W.A.J.Chapman-CBS. | |

## Semester – II

**Course Code** : **BSC-MTL1026**
**Course Title** : **Engineering Mathematics-1I**
**L-T-P/S=Credits** : **3-1-0 =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit –I**<br>**Vector Calculus:** Beta & Gamma functions. Differentiation of vector functions of scalar variables. Gradient of a scalar field, Divergence & Curl of a vector field and their properties. Line & surface integrals. Green's theorem, Stokes' theorem & Gauss' theorem both in vector & Cartesian forms (statement only) with simple applications. | **05** |
| 2 | **Unit-II**<br>**Ordinary Differential Equation(ODE):** Formation of ODE, definition of order and degree of ODE and solution, ODE's of first order, method of separation of variables, homogenous and non-homogenous differential equations and their solution, exactness and integrating factor, Bernoulli's equation, linear ODE's of $n^{th}$ order, operator method, method of undetermined coefficients, method variation of parameters, solution of simple simultaneous ODE's. | **06** |
| 3 | **Unit – III**<br>**Partial Differential Equation(PDE):** Formation of (PDE), Solution of PDE by direct integration, Lagrange's linear equation, Non-linear PDE of first order, Method of separation of variables, Heat, Wave & Laplace's equations (Two dimensional Polar & Cartesian Co-ordinates). | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | E. Kreysig, Advanced Engineering Mathematics, Wiley 10th edition. | 2011 |
| 2 | Frank Ayres , Vector Analysis, Mc Graw Hills, $6^{th}$ edition 2011. | |
| 3 | T. Marsden and W.H. Freeman,VectorCalclus, Freeman, 6 edition 2011. | |
| 4 | G. Simons, Differential Equations with Applications, TMH**,** McGraw-Hill Higher Education; 2 edition 1991. | |
| 5 | S.L. Ross, Differential Equations, Wiley $3^{rd}$ edition 1984. | |
| 6 | R. Zalman, A Course in Ordinary and PDEs, Academic Press, $1^{st}$ edition 2014. | |
| **Reference Books** | | |
| | | |
| | | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understand the concepts of vector calculus like directional derivative, gradient, divergence and curl, and their applications. | CO1 |
| 2 | Learn and apply the concepts of vector integral calculus for the computation of work done, circulation, and flux. | CO2 |
| 3 | Formulate the differential equations concerning physical phenomena like electric circuits, wave motion, heat equation etc. | CO3 |
| 4 | Learn various methods of solution of ordinary and partial differential equations. | CO4 |
| 5 | Solve various partial differential equations arising in heat conduction problems and wave propagation problems. | CO5 |

**Course Code** : **BTL-BS102**
**Course Title** : **Applied Chemistry**
**L-T-P/S=Credits** : **3-0-0 =3**
**Course Category** : **Engineering Science Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Chapter I: Atomic and Molecular Structure:** Principles of atomic structure (Review), molecular orbitals of diatomic molecules. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. | **05** |
| 2 | **Chapter II: Intermolecular forces and periodic properties**: Ionic, dipolar and van Der Waals interactions, Equations of state of real gases and critical phenomena. Effective nuclear charge, penetration of orbitals, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. | **06** |
| 3 | **Chapter III: Use of free energy in chemical equilibria:** Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and EMF. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion causes, effects and prevention. | **05** |
| 4 | **Chapter IV: Instrumental methods of chemical analysis and applications:** Spectroscopy: Principle of spectroscopy, Principle and simple applications of UV-Visible spectroscopy. Flame spectroscopy, Atomic absorption spectroscopy, Infrared spectroscopy, Principle and simple application of nuclear magnetic resonance and magnetic resonance imaging. Chromatography: Types, Principle and applications. | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Engineering Chemistry, by Manisha Agrawal. | |
| 2 | University chemistry, by B. H. Mahan. | |
| 3 | Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane. | |
| 4 | Fundamentals of Molecular Spectroscopy, by C. N. Banwell. | |
| 5 | A Textbook of Engineering Chemistry, Shashi Chawla. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Acquire basic knowledge in engineering chemistry. | CO1 |
| 2 | Apply their knowledge for various technological and engineering issues. | CO2 |
| 3 | Select and apply appropriate method for analysis, evaluation and interpretation of the concern results. | CO3 |

**Course Code** : **BTP-BS102**
**Course Title** : **Applied Chemistry Lab**
**L-T-P/S=Credits** : **0-0-2 =1**
**Course Category** : **Engineering Science Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | Determination of the enthalpy of neutralization of hydrochloric acid with sodium hydroxide. |
| 2 | Determination of integral enthalpy of solution of salts (endothermic and exothermic). |
| 3 | Determination of the rate constant of a reaction |
| 4 | Verification of Lambert-Beer's Law for potassium dichromate/potassium permanganate solution. |
| 5 | Determine the pH of the given aerated drinks fruit juices, shampoos andsoaps using digital pH meter and pH paper. |
| 6 | Estimation of hardness of water using EDTA titration. |
| 7 | Standardization of KMnO4 solution by Mohr's salt. |
| 8 | Conductometric titration for a) Determination of the strength of a given HCl solution by titration against a standard NaOH solution. b) Analysis of a mixture of strong and weak acid by strong base. |
| 9 | Thin layer chromatographic separation. |
| 10 | Synthesis and purification of polymer/drug. |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | AICTE's Prescribed Textbook: Chemistry – I with Lab Manual, Khanna Book Publishing. | |
| 2 | Rao M. V. B., Laboratory Mannual for Engineering and Physical Chemistry, Studium Press (India) PVT. Ltd. 2013. | |
| 3 | Israel V. A., Vogel's Qualitative Inorganic Analysis, Publisher: Pearson Education Limited, ISBN: 9780582218666, 0582218667. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Function on research areas in multidisciplinary subjects. | CO1 |
| 2 | Design economically, environmental friendly and new methods of synthesis for various needful products. | CO2 |
| 3 | Perform titration for various kinds such as acid-base titration etc. | CO3 |

**Course Code** : **DCC –MEL1012**
**Course Title** : **Engineering Mechanics**
**L-T-P/S=Credits** : **3-1-0 =4**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit-I**<br>Force and Force Systems: Coplanar, Concurrent and Non-Concurrent Force Systems, Resultant and Resolutions, Forces in Space, Vectors, Operations on Force using Vectors, Moment of Force, Varignon's Theorem, Couple and Its Properties, Resultant of a Spatial Force System. | **04** |
| 2 | **Unit-II**<br>Equilibrium-Equilibrium of a Particle, External & Internal Forces, Equilibrium of a Rigid Body, Types of Supports, Structural Members and Beams, Reactions of Beams. Properties of Lines, Areas and Solids: Centre of Gravity, Centroid of Lines (Basic and Composite Areas), Built-Up Sections, Product of Inertia, Mass Moment of Inertia. | **06** |
| 3 | **Unit-III**<br>Trusses, Frames and Mechanisms: Connected Bodies, Two Force and Three Force Members, Trusses, Method of Joints, Method of Sections, Determinateness of Truss, Rigid and Non Rigid Frames, Simple Mechanisms, Space Frames. | **05** |
| 4 | **Unit-IV**<br>Friction: Type of Friction, Characteristics of a Dry Friction, Equilibrium on Rough Inclined Place, The Wedge, The Screw Jack, Journal Bearing, Axle Friction, Thrust Bearing, Disc Friction, Clutches. | **05** |
| 5 | **Unit-V**<br>Introduction to Dynamics, Kinematics and Kinematics of Particles in Rectilinear and Curvilinear Motions, Projectile, Kinematics and Kinematics of a Rigid Body. Usage of D'Alembert's Principle, Work and Energy, Impulse and Momentum Principles. | **04** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Jurnarkar, S.B. and Shah, H.J.–Applied Mechanics,Charotar | |
| 2 | Merium and Kraige–Engineering Mechanics, John Wiley &Sons. | |
| 3 | Sharma, S.M.–Engineering Mechanics, Kirti Publications,Jammu. | |
| 4 | Engineering Mechanics by Huges and Martin, E.L.B.S. and Macmillan. | |
| 5 | Beer and E.R. Johnstons–Vector Mechanics, McGraw-Hill, NewYork | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Acquiring basic knowledge related to Forces and their behavior, both in Statics and Dynamics. | CO1 |
| 2 | Formulation of methodology to solve for forces in different Engineering Systems. | CO2 |

| | | |
|---|---|---|
| 3 | Students learn to predict the effect of force on Static Bodies and Bodies in Motion, which is significantly required in Design | CO3 |
| 4 | A learning to find engineering in daily life resulting in more efficient systems as compared to the conventional one. | CO4 |
| 5 | Students should learn the importance of this subject as a basis for Mechanics of Material, Kinematics of Machines, Machine Design etc. | CO5 |

**Course Code** **: DCC –MEL1112**
**Course Title** **: Material Science and Engineering**
**L-T-P/S=Credits** **: 3-0-0 =3**
**Course Category** **: Engineering Course**
**Pre-requisite Courses (if any)** **: ---**
**Equal Course Code (if any)** **: ---**
**Equivalent Course Code (if any)** **: ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit-I**<br>Crystallography: Review of Crystal Structure, Space Lattice, Crystal Planes and Crystal Directions, Coordination Number, Number of Atoms Per Unit Cell, Atomic Packing Factor. | **03** |
| 2 | **Unit-II**<br>Imperfection & Deformation of Metal: Crystal Imperfections, Type of Defects and Effects on Metal Properties, Deformation of Metal. Mechanism, Yield Point Phenomena, Strain Ageing, Work Hardening, Bauschinger Effect, Season Cracking, Recovery, Recrystallization and Grain Growth. | **05** |
| 3 | **Unit-III**<br>Solid Solution and Phase Diagram: Introduction to Single and Multiphase Solid Solutions and Types of Solid Solution, Importance and Objective of Phase Diagram Systems, Phase and Structure Constituents, Cooling Curves, Unary & Binary Phase Diagrams, Gibbs's Phase Rule, Lever Rule, Eutectic, and Eutectoid Systems, Peritectic and Peritectoid Systems. Iron Carbon Equilibrium Diagram and TTT Diagram. | **07** |
| 4 | **Unit-IV**<br>Heat Treatment: Principles, Purpose, Classification of Heat Treatment Processes, Annealing, Normalizing, Stress Relieving, Hardening, Tempering, Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening, Allotropic Transformation of Iron and Steel, Properties of Austentic, Ferrite, Pearlite and Martensite. | **05** |
| 5 | **Unit-V**<br>Creep Concept, Creep Curve, Mechanism, Factors, Testing and Prevention. Corrosion-Type and Prevention of Corrosion. Fracture, Failures of Metals-Failure Analysis. Fatigue-Characteristics, Mechanism and Factors Affecting Fatigue. | **04** |
| 6 | **Unit-VI**<br>Plastic. Composite and Ceramics | **02** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Elements of Material Science and Engineering Van Vlack. Wesley Pub. | |
| 2 | Material Science – Narula, Narula and Gupta, New Age Publishers. | |
| 3 | Material Science and Engineering- V.Raghavan, Prentice Hall of India Pvt. | |
| 4 | Material Science and Engineering- an Introduction – Callister; W.D., John Wiley & Sons, Delhi. | |

| | | |
|---|---|---|
| 5 | Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, | |
| 6 | Essentials of Materials Science & engineering – Donald R. Askeland, Pradeep P.Phale. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | To understand the fundamental principles conducting and connecting the structure, processing, properties, and performance of materials systems. | CO1 |
| 2 | To understand the importance and uses of Iron Carbon Equilibrium Diagram and Heat Treatment of metals. | CO2 |
| 3 | To be able to select materials for design of mechanical components and understand the contemporary issues relevant to materials science and engineering. | CO3 |

**Course Code : DCC-MEP1112**
**Course Title : Material Science and Engineering Lab**
**L-T-P/S=Credits : 0-0-2 =1**
**Course Category : Engineering Science Course**
**Pre-requisite Courses (if any) :**
**Equal Course Code (if any) :**
**Equivalent Course Code (if any) :**

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | Study of various mechanical properties. Computing the theoretical density and comparing it with actual density of given specimen materials (mild steel, aluminum, lead and copper etc). |
| 2 | Find the ductility of a mild steel sheet using the Ericsson testing machine and measure deformation. |
| 3 | To study crystal structure and crystal imperfections using models. |
| 4 | To study the inverted type metallurgical microscope used for optical study of crystal structure. |
| 5 | To prepare the specimen for microscope examination using a double disc polishing machine. |
| 6 | To study the crystal structure of a given specimen ((mild steel, aluminum, and copper etc) using a metallurgical microscope. |
| 7 | To harden, normalize and annealing mild steel specimens using electric furnaces and estimate changes in hardness level obtained after the heat treatment process. |
| 8 | To determine the hardenability of a given steel by Jominy End Quench method. |
| 9 | To determine the hardness of a prepared sample using a digital Micro Vickers Hardness Tester. |
| 10 | To analyze the internal cracks of specimens using UltraSonic Flaw Detector. |

**Course Code** : **SEC-MEP1116**
**Course Title** : **Engineering Graphics with CAD**
**L-T-P/S=Credits** : **1-0-2 =2**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Section-A**<br>Introduction of Engineering Graphics: Drawing instruments and their uses, Orthographic Projections: Planes of projection–Projection of points in different quadrants. Orthographic Projection of Straight Line parallel to one plane and inclined to the other plane–Straight Line inclined to both the planes–True Length and inclination of lines with reference planes–Traces of line–Projection of Planes, Projection of Solids, Isometric Drawing: Types of Projection-Orthographic, Isometric, Oblique and Perspective Projections, exercises on Isometric drawings.<br><br>Section of Solids: Classification of Solids, Section plane perpendicular to one plane and parallel to other, Section plane inclined to one plane and perpendicular to other plane.<br>Development of Surfaces: Principle, Engineering applications and Methods of development. | **06** |
| 2 | **Section-B**<br><br>Introduction: Introduction to Computer Aided Drafting (CAD), Reasons for implementing CAD, Applications of CAD, Benefits/limitations of CAD, Hardware of CAD system, Types of CAD software. Introduction to other drafting software such as Mechanical Desktop and Auto Cad Electrical<br><br>Introduction to Auto CAD: Starting AutoCAD, AutoCAD screen components, creating a drawing on AutoCAD, invoking different commands, Dialog boxes, Coordinate Systems, Exercises on Drawing of Line, Circle, Arc, Ellipse, Polygon, etc.<br><br>Drawing Aids and Editing Commands: Layers, Drafting Settings, Object Snaps, Function and Control keys, various Editing Commands, Editing the Objects with Grips, Grip Types.<br><br>Creating Text, Dimensions and Tolerances in AutoCAD: Creating Text, Editing Text, Styles of Dimensioning, Dimensioning System Variables, Editing/Updating Dimensions, Adding Tolerances | **10** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Ellen Filkensten-AutoCAD 2006 & AutoCAD LT 2006 Bible, Wiley, New York. | 2006 |
| 2 | Sham Tickoo -AutoCAD, Tata McGraw Hill, New Delhi. | 2005 |
| 3 | George Omura - AutoCAD, SybexInc. | |
| 4 | Bhat, N.D. and Panchal, V. M. - Engineering Drawing, Charotar Publishers,Anand. | |
| 5 | Narayana, K.L. and Kannaiah, P.-Engineering Graphics, Tata McGraw Hill, New Delhi. | |
| 6 | Gill, P.S-Engineering Drawing, S.K Kataria & Sons, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Draw orthographic projections of sections. | CO1 |
| 2 | Use architectural and engineering scales with accuracy. | CO2 |
| 3 | Work with zeal of office practices and standards. | CO3 |
| 4 | Convert sketches to engineered drawing. | CO4 |
| 5 | Perform Two & Three dimensional drawing. | CO5 |
| 6 | Understanding and Editing Drawings using AutoCAD software | CO6 |

**Course Code** **: VAC-PCL1067**
**Course Title** **: Discourse on Human Virtues**
**L-T-P/S=Credits** **: 3-0-0 =3**
**Course Category** **:**
**Pre-requisite Courses (if any)** **: ---**
**Equal Course Code (if any)** **: ---**
**Equivalent Course Code (if any)** **: ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit –I**<br>1. What is Value Education?<br>2. Knowledge and Skill<br>3. Value and Virtue<br>4. Moral Agency and the Notion of Dharma<br>5. Freedom of Will and Determinism | **14** |
| 2 | **Unit-II**<br>1. Understanding Human Existence: Human Being and Human Person<br>2. The Basic Human Aspirations: Continuous Happiness and Prosperity<br>3. Understanding harmony at the level of Individual, Family and Society | **13** |
| 3 | **Unit-III**<br>1. Understanding harmony at the level of Nature<br>2. Cardinal Human Virtues such as Compassion, Wisdom, Justice, Tolerance, Non-violence, Service to Humanity with the help of suitable illustrations | **13** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Das, Gurucharan (1990), *The Difficulty of Being Good*(Chapter 3), New Delhi: Penguin Books. | 1990 |
| 2 | Frankfurt, Herry G. (1971). Freedom of the Will and the Concept of a Person. *The Journal of Philosophy*, 68 (1): 5 – 20. | 1971 |
| 3 | Gaur, R.R. et. al.(2006), *A Foundation Course in Human Values and Professional Ethics*. New Delhi: Excel Books. | 2006 |
| 4 | Excerpts from relevant books supplied by the instructor as and when required. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understand the relevance of human values and peaceful co-existence | CO1 |
| 2 | Widen their perspectives in moral decision making | CO2 |
| 3 | Develop right understanding with respect to the basic aspirations of human life | CO3 |
| 4 | Gain holistic understanding of the interrelatedness of individual, family, society and nature | CO4 |
| 5 | Enhance clarity, assurance & purposefulness of life | CO5 |

**Semester – III**

**Course Code** : **ESC-MEL2211**
**Course Title** : **Thermodynamics**
**L-T-P/S=Credits** : **3-0-0 =3**
**Course Category** :
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit I:**<br>Introduction–Macroscopic and Microscopic Approaches; Thermodynamic Systems Closed, Open and Isolated; Property, State, Path and Process; Quasi-Static Process; Temperature, Zeroth Law of Thermodynamics, Concept of Ideal Gas, Type of Thermometers,<br>Work Transfer as a Path Function, P-dv Work in Various Quasi-Static Processes, Free Expansion, Heat Transfer as a Path Function. First Law of Thermodynamics-Application to Closed System undergoing a Cycle, Closed System undergoing a Change of State, Different forms of Stored Energy, Enthalpy, PMM1. First Law applied to Flow Processes, Mass and Energy Balance in a Simple Steady Flow Process, Some Examples. Second Law of Thermodynamics–Statements of Kelvin-Planck and Clausius, Refrigerator and Heat Pump, Reversibility and Irreversibility, Causes of Irreversibility, Conditions of Reversibility, Carnot Cycle, Introduction to Entropy, Temperature-Entropy Plot. | **08** |
| 2 | **Unit II:**<br>Elements of Heat Transfer: Basic Concepts, Conduction Heat Transfer, Convection Heat Transfer, Radiation Heat Transfer, Heat Exchangers. | **04** |
| 3 | **Unit III:**<br>Properties of Pure Substance-PV-T, PT, TS Diagram, Mollier Diagram–Mixture of Gaseous and Vapours- Mixtures of Ideal Gases–Dalton's Law-Thermodynamic. Properties of Mixture–Mixtures of Ideal Gases and Vapours-Psychrometric Principles-Psychometrics Chart-Applications. Introduction to Refrigeration–Vapour Compression Refrigeration. | **05** |
| 4 | **Unit IV:**<br>Vapour Power & Gas Power Cycles: Simple Steam Power Cycle, Rankine Cycle, Actual Vapour Cycle Processes, Comparison of Rankine and Carnot Cycle, Reheat and Regenerative Cycles, Ericsson Cycle, Otto Cycle, Diesel Cycle and Dual Cycle. | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Nag, P.K.- Engineering thermodynamics, Tata McGraw Hill Publishers, | |
| 2 | Vasandani, V.P.and Kumar, D.S.-Heat Engineering, metropolitan book | |
| 3 | Kumar, D.S.-thermal science and engineering, Kataria & SonsPublishers, | |
| 4 | Gupta and Prakash –Engineering thermodynamics, S.Chand Publishers, | |
| 5 | Kothandaraman, C.P, and Dornkundwar, S.-thermal Engineering, Dhanpat Rai & Sons, New Delhi. | |
| 6 | Cengel and Boles Thermodynamics & Engineering Approach, Tata Mc GrawHill Publishers, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Apply the knowledge of thermodynamics to temperature scales. | CO1 |
| 2 | Solve the practical thermodynamic problems by applying first law and steady flow energy equations. | CO2 |
| 3 | Analyze the problems on heat engines, refrigeration and entropy by applying the second law of thermodynamics. | CO3 |
| 4 | Evaluate the thermodynamic properties of the steam. | CO4 |
| 5 | Evaluate the performance of air standard cycles and vapor power cycles. | CO5 |

**Course Code** **: ESC-CSL1028**
**Course Title** **: Programming using Python**
**L-T-P/S=Credits** **: 2-0-2 =3**
**Course Category** **:**
**Pre-requisite Courses (if any)** **: ---**
**Equal Course Code (if any)** **: ---**
**Equivalent Course Code (if any)** **: ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Introduction**<br>Introduction to importance of IDEs like Spyder (Anaconda)/PyCharm for professional programming, explore Python shell as a calculator and for inputting Python expressions directly, HelloWorld program in Python script, Python keyword and Identifiers, Indentation, Comments, Data Types in. Operators in Python: comparison, arithmetic, logical, Boolean, bitwise, assignment. Python: numbers, list, tuple, strings, set, dictionary, conversion between various data types | |
| 2 | **Basic constructs**<br>Input and Output in Python, if-else , for loop, while loop, break, pass, continue, creating Functions, functions with arguments, returning values from functions, lambda expressions, recursion, global and local variables, Importing other modules/packages and using their functions, creating random numbers/random-choice to create programs for simple guessing games like Rock –Paper-Scissors. Problems on 1D/2D/3D arrays using list. Problem solving using a dictionary as a look-up table. | |
| 3 | **Object Oriented Programming**<br>Basics of Object oriented programming: Class and Object. Defining variables and functions inside class. Creating objects, Inheritance, Multiple and MultiLevel Inheritance, Function over-riding, the concept of composing objects of a different class in an object, problems on object composition | |
| 4 | **GUI creation in Python**<br>GUI creation using Python's de-facto GUI package like tkinter or alternative packages like: wxPython, PyQt (PySide), Pygame, Pyglet, and PyGTK. Creating labels, buttons, entry (textbox), combobox, checkbutton, radiobutton, scrolledText (textarea), spinbox, progressbar, menubar, filedialog, tabs etc. Creating GUI simple games like Tic-Tac-Toe | |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Think Python 2nd Edition - How to Think Like a Computer Scientist, Allen B Downey, O'Reilly publication | |
| 2 | Learn Python 3 the Hard Way, Zed A. Shaw, Pearson publication | |
| 3 | Head First Programming: A Learner's Guide to Programming using the Python Language, Paul Barry David Griffiths Barry Griffiths, O'Reilly publication | |
| 4 | Dive into Python 3, Mark Pilgrim, Apress publication | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Know the basic syntax and Data Structures in Python. | CO1 |
| 2 | Think and Design solution in Object Oriented as well as Procedural way. | CO2 |
| 3 | Enjoy coding and competing at online programming sites like Codechef, HackerEarth etc. | CO3 |

**Course Code** **: DCC-MEL2015**
**Course Title** **: Kinematics of Machines**
**L-T-P/S=Credits** **: 3-0-0 =3**
**Course Category** **: Engineering Course**
**Pre-requisite Courses (if any)** **: ---**
**Equal Course Code (if any)** **: ---**
**Equivalent Course Code (if any)** **: ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Introduction**<br>Links, Mechanisms, Kinematic Pair and Chains, Principles of Inversion, Inversion of a Four Bar Chain, Slider-Crank-Chain, Double Slider-Crank Chain and Their Inversions, Kinematic Pairs, Graphical (Relative Velocity Vector and Instantaneous Center Methods), Analytical Methods for Displacement, Velocity, and Acceleration of Mechanisms Including Corriolis Components. Lower Pairs-Universal Joint, Calculation of Maximum Torque, Steering Mechanisms (Ackerman and Davis Approximate Steering Mechanism), Engine Indicator, Pantograph, Straight Line Mechanisms. | |
| 2 | **Belts, Ropes and Chains-Material**<br>Types of Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, Velocity Ratio, Crowning Shaft Pulley, Loose and Fast Pulley, Stepped or Cone Pulleys, Ratio of Tension on Tight and Slack Sides of Belts, H.P Transmitted by Belts with consideration of Creep and Slip, Centrifugal Tensions and Its Effect on H.P Transmitted, Use of Gravity, Idle, Flat, V- Belts and Rope Materials, Length of Belt, Rope and Chain Drives. | |
| 3 | **Cams**<br>Types of Cams and Followers, Definitions of Connected Terms, Displacement Velocity and Acceleration Diagrams (Cam and Followers), Analytical and Graphical Design of Cam Profiles with Various Motions, Analysis of Follower Motion (Circular, Convex, Tangent Cam Profiles), Calculation of Pressure Angle. | |
| 4 | **Friction Devices**<br>Concepts of Frictions and Wear Related to Bearings and Clutches, Types of Brakes, Principle of Function of Brakes of Various Types, Braking of Front and Rear Tyres of a Vehicle, Problems to Determine Braking Capacity, Types of Dynamometers. | |
| 5 | **Flywheels**<br>Turning Moment and Crank Effort Diagrams for Reciprocating Machines, Fluctuations of Speed, Coefficient of Fluctuation of Speed and Energy, Determination of Flywheel Mass and Dimensions for Engines and Punching Machines Governors-Function, Types and Characteristics of Governors, Watt, Porter and Proell Governor. Hartnell and Willson-Hartnell, Spring Loaded Governors, Sensitivity, Stability, Isochronisms And Hunting of Governors, Governor Effort and Power. | |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Rao, J.S. and Dukkipati, R.V. – Mechanism and Machine Theory, Wiley-Eastern, New Delhi. | |

| | | |
|---|---|---|
| 2 | Ballaney, P.L. – Theory of Machines, Khanna Publishers, New Delhi. | |
| 3 | Khurmi, R.S. and Gupta, J.K. – Theory of Machines, Eurasia Publishing House (P) Ltd, New Delhi. | |
| 4 | Ghosh, A. and Mallick A.K.-Thoery of Mechanisms and Machines, Affiliated East-West Press Pvt. Ltd., New Delhi. | |
| 5 | Rattan S.S.-Theory of Machines, Tata McGraw Hill, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Get an exposure to various methods of analysis. Learn the fundamentals of Kinematic design of mechanisms for specific requirements in industrial application and or to bring the comfort of human beings. Understand Velocity and Acceleration diagrams | CO1 |
| 2 | Understand basic working of Belts, Ropes and Chains. | CO2 |
| 3 | Understand basic working of cam and follower. | CO3 |
| 4 | Understand basic Concepts of Frictions and Wear Related to Bearings and Clutches, Learn concept of braking | CO4 |
| 5 | Understand basic working of Flywheels, Governors | CO5 |

**Course Code : DCC-MEL2231**
**Course Title : Fluid Mechanics**
**L-T-P/S=Credits : 3-1-0 =3**
**Course Category :**
**Pre-requisite Courses (if any) : ---**
**Equal Course Code (if any) : ---**
**Equivalent Course Code (if any) : ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Unit I:** Concept of a Fluid, The Fluid as a Continuum, Pressure, Force, Density, Specific Weight, Compressibility, Capillarity, Surface Tension, Dynamic and Kinematic Viscosity, Pascal's Law, Newtonian and Non-Newtonian Fluids. Hydrostatic Pressure on Plane and Curved Surfaces, Centre of Pressure, Buoyancy, Floation, Stability of Submerged and Floating Bodies, Metacentric Height, and Periodof Oscillation. | **07** |
| 2 | **Unit II:** Eulerian and Lagrangian Approach, Classification and Representation of Fluid Flow, Path Line, Stream Line and Streak Line, Equation for Acceleration, Continuity Equation, Rotational and Irrotational Flow, Velocity Potential and Stream Function, Circulation and Vorticity, Vortex Flow. | **05** |
| 3 | **Unit III:** Euler's Momentum Equation-Bernoulli's Equation and Its Limitations, Momentum and Energy Correction Factors, Flow Through Orifices and Mouthpieces, Notches and Weirs, hydraulic coefficients, Timeof Emptying a Tank, Application of Bernoulli's Theorem, Orifice Meter, Venturimeter and Pitot Tube, Manometry. | **05** |
| 4 | **Unit IV:** Hagen-Poiseullie Equation, Laminar and Turbulent Flowin Pipes, Critical Reynolds Number, Hydraulic Radius, Darcy-Weisback Equation for Major Loss, Minor Losses, Pipes in Series and Parallel, Concept of Equivalent Pipe, Boundary Layer Flow Theory, Boundary Layer Separation, Drag and Lift forces, Drag coefficient for a Rectangular Plate, Drag Coefficient for Flow around a Cylinder. | **05** |
| 5 | **Unit V**: | **03** |

| | | |
|---|---|---|
| | Dimensional Analysis and Similarity: Dimensional Homogeneity, Rayleigh's Method and Buckingham's Π-Theorem, Model Studies and Similitude, Dimensionless Numbers and their Significance. | |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Som S.K. and Biswas, G - Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill, New Delhi. | |
| 2 | Cengel and Cimbla (2014), Fluid Mechanics: Fundamentals and Applications, 3rd Edition, McGraw Hill Education | |
| 3 | Agrawal S. K.- Fluid Mechanics and Machinery, Tata McGraw-Hill, New | |
| 4 | Kumar, D. S. - Fluid Mechanics and Fluid Power Engineering, Kataria& Sons Publishers, New Delhi. | |
| 5 | Ramamrutham S., Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understand the basic concepts of Fluid Mechanics. | CO1 |
| 2 | To develop an understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow. | CO2 |
| 3 | To imbibe basic laws and equations used for analysis of static and dynamic fluids. | CO3 |
| 4 | To inculcate the importance of fluid flow measurement and its applications in industries | CO4 |

**Course Code : DCC-MEP2231**
**Course Title : Fluid Mechanics Lab**
**L-T-P/S=Credits : 0-0-2 =2**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) :**
**Equal Course Code (if any) :**
**Equivalent Course Code (if any) :**

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | To demonstrate Bernoulli's theorem experimentally. |
| 2 | To determine the coefficient of discharge for different types of notches. |
| 3 | To determine the coefficient of discharge of Broad crested Weir and Ogee Weir. |
| 4 | To determine the coefficient of discharge of a venturimeter. |
| 5 | To determine the coefficient of discharge of an Orifice meter. |
| 6 | To determine the losses in flow due to pipe friction on a Major losses apparatus. |
| 7 | To determine the losses in the flow due to sudden expansion and sudden contraction on Minor losses apparatus. |
| 8 | To study flow in pipes and determine the losses due to pipe bend and elbow on Minor losses apparatus. |
| 9 | To determine the skin friction coefficient for different Reynolds's number on a Laminar and turbulent flow apparatus |
| 10 | To demonstrate the laminar and turbulent flow in a transparent pipe using Reynolds's apparatus. |

**Course Code** : **DCC-MEL2014**
**Course Title** : **Strength of Materials - I**
**L-T-P/S=Credits** : **3-1- =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Simple Stresses and Strains**<br>Concept of Stress and Strain, St. Vernant's Principle, Stress and Strain Diagram, Hooke's Law, Young's Modulus, Poisson Ratio, Stress at a Point, Stress and Strains in Bars subjected to Axial Loading, Modulus of Elasticity, Stress Produced in Compound Bars subject to Axial Loading, Temperature Stresses and Strain Calculations Due To Application of Axial Loads and Variation of Temperature in Single and Compound Bars. Compound Stress and Strains, Two Dimensional System, Stress at a Point on a Plane, Principal Stresses and Principal Planes, Mohr's Circle of Stresses, Hooke's Law, Principal Stresses Related to Principal Strains. | **07** |
| 2 | **Bending Moment and Shear Force Diagrams**<br>S.F and B.M Definitions. BM and SF Diagrams for Cantilevers, Simply Supported Beams with or Without Overhangs and Calculation of Maximum BM and SF and the Point of Contra flexure Under A) Concentrated Loads, B) Uniformity Distributed Loads Over Whole Span or Part of Span, C) Combination of Concentrated Loads and Uniformly Distributed Loads, D) Uniformity Varying Loads, and E) Application of Moments. | **05** |
| 3 | **Slope and Deflection**<br>Relationship between Moment, Slope and Deflection, Moment Area Method; Methods of Integration; Macaulay's Method: Use of these Methods to Calculate Slope and Deflection for A) Cantilevers, B) Simply Supported Beams With or Without Overhang, C) Under Concentrated Loads, Uniformly Distributed Loads or Combination of Concentrated and Uniformly Distributed Loads. | **05** |
| 4 | **Theory of Bending Stresses in Beams Due to Bending**<br>Assumptions in Simple Bending Theory, Derivation of Formula: Its Application to Beams of Rectangular, Circular and Channel, I & T-Sections, Combined Direct and Bending Stresses in aforementioned Sections, Composite Beams.<br>Torsion-Derivation of Torsion Equation and its Assumptions, Applications of the Equation to Hollow and Solid Circular Shafts, Torsional Rigidity, Combined Torsion and Bending of Circular Shafts Principal Stress and Maximum Shear Stresses Under Combined Loading of Bending and Torsion, Analysis and Close-Coiled-Helical Springs. | **06** |
| 5 | **Columns and Struts**<br>Failure of Columns, Euler's Formulas, Rankine-Gordon's Formula, Johnson's Emperical Formula for Axially Loaded Columns and their Applications. | **03** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Singer, F.P. and Pytel, A.- Strength of Materials, Harperand Row H. Kogakusha Publishers, New York | |
| 2 | Popov, E.P.-Mechanics of Materials, Prentice Hall India, New Delhi | |
| 3 | Bedi, D. S.- Strength of Materials, Khanna Book Publishing Company, New Delhi. | |
| 4 | Lehri, R.S. and Lehri, A.S.-Strength of Materials, Kataria & Sons Publishers, New Delhi | |

| | | |
|---|---|---|
| 5 | Khurmi, R.S.-Strength of Materials, Khanna Publishers, New Delhi | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understand the concept and principles applied to members under various loadings and the effects of these loadings. | CO1 |
| 2 | Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member. | CO2 |
| 3 | Analyze the shear force and bending moment diagrams of the beams subjected to different types of loads. | CO3 |
| 4 | Analyze and design structural members subjected to tension, bending and combined stresses using the fundamental concepts of stress and elastic behavior of materials. | CO4 |
| 5 | Analyze the load and deflection of beams and columns | CO5 |

**Course Code : DCC-MEP 2014**
**Course Title : Strength of Materials Lab**
**L-T-P/S=Credits : 0-0-2 =1**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) :**
**Equal Course Code (if any) :**
**Equivalent Course Code (if any) :**

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | Tensile Tests on Ductile and Brittle Materials and to Draw Stress-Strain Curve and to Determine Various Mechanical Properties. |
| 2 | Compression Test on C.I. and to Determine Ultimate Compressive Strength. |
| 3 | Shear Tests on Different Materials and to Determine Ultimate Shear Strength. |
| 4 | Hardness Tests to Determine Hardness of Materials – Rockwell or Brinell or Vicker's Test |
| 5 | Impact Test to Determine Impact Strength. |
| 6 | Torsion Test and to Determine Torsional Strength. |
| 7 | Fatigue & Creep Tests. |
| 8 | Tests on Close Coiled Helical Spring. |
| 9 | Determination of Buckling Loads of Long Columns with Different End Conditions |

**Course Code : SEC-MEL 2013**
**Course Title : Machine Drawing with CAD**
**L-T-P/S=Credits : 1-0-2 =2**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) : ---**
**Equal Course Code (if any) : ---**
**Equivalent Course Code (if any) : ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Introduction**<br>Principles of Drawing, Requirements of Production Drawing, Sectioning and Conventional Representation, Dimensioning, Symbols of Standard Tolerances, Machining Symbols. | **10** |
| 2 | **Fasteners**<br>Various Types of Screw Threads, Types of Nuts and Bolts, Screwed Fasteners, Welding Joints, and Riveted Joints. | **15** |
| 3 | **Assembly and Dis-Assembly** of following using a Computer-Aided Drafting Package | **26** |

| | | |
|---|---|---|
| | such as AutoCAD or Mechanical Desktop.<br><br>A) Couplings: Solid or Rigid Coupling, Protected type Flange Coupling, Pin Type Flexible Coupling, Muff Coupling, Oldham, Universal Coupling, Claw Coupling, Cone Friction Clutch. Free Hand Sketch of Single Plate Friction Clutch<br>B) Knuckle and Cotter Joints<br>C) Pipe and Pipe Fittings: Flanged Joints, Spigot and Socket Joint, Union Joint, Hydraulic and Expansion Joint.<br>D) IC Engine Parts: Piston, Connecting Rod, Crankshaft<br>E) Boiler Mountings: Steam Stop Valve, Feed Check Valve, Safety Valve, Blow-off Cock.<br>F) Bearings: Swivel Bearing, Thrust Bearing, Plummer Block, Angular Plummer Block.<br>G) Miscellaneous: Screw Jack, Drill press Vice, Crane Hook.<br>H) Machine tool Parts: Lathe Tail Stock, Tool post. | |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Bhatt, N.D. – Machine Drawing, Charotar Publications, Anand. | |
| 2 | Gill, P.S. – Machine Drawing, Kataria and Sons, New Delhi. | |
| 3 | Sidheshwar, N. – Machine Drawing, Tata McGraw Hill, New Delhi. | |
| 4 | Ellen Filkensten – AutoCAD 2006 & AutoCAD LT 2006 Bible, Wiley, New York. | 2006 |
| 5 | Sham Tickoo – AutoCAD 2005, Tata McGraw Hill, New Delhi | 2005 |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understand how to read drawing sheets in industries. | CO1 |
| 2 | To gather the understanding to make different assembly drawings like screw jack, Tailstock of lathe and cross head. | CO2 |
| 3 | To learn concepts of limits, fits and tolerances. | CO3 |
| 4 | To gather the understanding to make different assembly drawings like Couplings, Joints, Pipe & pipe fittings. | CO4 |
| 5 | To gather the understanding to make different assembly drawings like boiler mountings, bearings machines tool parts. | CO5 |

**Semester- IV**

**Course Code : ESC-MEL2212**
**Course Title : Thermal Engineering**
**L-T-P/S=Credits : 3-0-0 =4**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) : ---**
**Equal Course Code (if any) : ---**
**Equivalent Course Code (if any) : ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Steam Generators** Classification of Boilers with Details, Merits and Demerits of Fire Tube and Water Tube Boilers, High Pressure Boilers, Boiler Mounting and Accessories, Draught and Performance of Boilers. | **03** |
| 2 | **Steam Nozzles** Types of Nozzles, Steam Flow Through Nozzles, Condition for Maximum Discharge, Supersaturated Flow Through Nozzles. | **03** |
| 3 | **Fuels and Combustion** Types of Fuels, Calorific Value of Fuels, Combustion Equation for Hydrocarbon Fuel, Conversion of Volumetric Analysis to Mass Analysis, Determination of Excess Air Supplied. Determination of Percentage Carbon in Fuel Burning to CO and CO2. Determination of Minimum Quantity of Air Supplied to Gaseous Fuels, Flue Gas Analysis, and Bomb Calorimeter Orsat Apparatus. | **06** |
| 4 | **Compressors** Compression Processes, Work of Compression, Single-Stage Reciprocating Air Compressor, Volumetric Efficiency, Multi-Stage Compression, Rotary Compressors. | **03** |
| 5 | **Turbines** Impulse and Reaction Principles of Turbines, Compounding, Single and Multistage Turbines, Speed Regulations. | **03** |
| 6 | **Steam Condenser** Types, Various Efficiencies, Air Leakage, Cooling Towers and Applications | **03** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Nag, P.K.- Engineering Thermodynamics, Tata McGraw Hill Publishers, New Delhi. | |
| 2 | Vasandani, V.P. and Kumar, D.S.-Heat Engineering, Metropolitan Book Co. | |
| 3 | Kumar, D.S.-Thermal Science and Engineering, Kataria & Sons Publishers, New Delhi. | |
| 4 | Gupta And Prakash –Engineering Thermodynamics, S.Chand Publishers, New Delhi. | |
| 5 | Kothandaraman, C.P, and Dornkundwar, S.-Thermal Engineering, Dhanpat Rai & Sons, New Delhi. | |
| 6 | Cengeland Boles Thermodynamics & Engineering Approach, Tata McGraw Hill Publishers, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Analyze the performance of air compressors and solve numerical related to the performance of single stage and multi stage air compressors | CO1 |

| | | |
|---|---|---|
| 2 | Describe the function of steam condensers, classification and condenser efficiencies and solve numerical problems. | CO2 |
| 3 | Explain the working principles of different boilers. | CO3 |
| 4 | Analyze the performance of vapour power cycles and steam nozzles and solve numericals. | CO4 |
| 5 | Analyze the performance of steam in different stages of steam turbine. | CO5 |

**Course Code** : **ESC – MEP 2212**
**Course Title** : **Thermal Engineering Lab**
**L-T-P/S=Credits** : **0-0-2 =1**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** :
**Equal Course Code (if any)** :
**Equivalent Course Code (if any)** :

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | Determination of Flash Point and Fire Point |
| 2 | Determination of Dryness Fraction of Steam |
| 3 | Flue Gas Analysis |
| 4 | Bomb Calorimeter Experiment |
| 5 | Study of Various Types of Boilers, Boiler Mountings and Accessories |
| 6 | Performance and Energy Balance Test on a Fire Tube/ Water Tube Boiler. |
| 7 | Performance of Single Stage/ Multi Stage Reciprocating Compressor |
| 8 | Study of Various Types of Turbines |
| 9 | Study of Refrigeration System, Charging and Troubleshooting |
| 10 | Determination of COP of a Refrigeration System. |
| 11 | Study of Air Conditioning System, Charging and Troubleshooting. |

**Course Code** : **DCC-MEL2232**
**Course Title** : **Fluid Machines**
**L-T-P/S=Credits** : **3-1-0 =4**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Impact of Free Jets**<br>Impulse – Momentum Principle, Jet Impingement - on a Stationary Flat Plate, Inclined Plate and a Hinged Plate, at the Center of a Stationary Vane, on a Moving Flat Plate, Inclined Plate, A Moving Vane and a Series of Vanes, Jet Striking Tangentially at the tip of a Stationary Vane and Moving Vane(s), Jet Propulsion of Ships. Problems. | **05** |
| 2 | **Impulse Turbines**<br>Classification – Impulse and Reaction Turbines, Water Wheels, Component Parts, Construction, Operation and Governing Mechanism of a Pelton Wheel, Work Done, | **05** |

| | | |
|---|---|---|
| | Effective Head, Available Head and Efficiency of a Pelton Wheel, Design Aspects, Speed Ratio, Flow Ratio, Jet Ratio, Number of Jets, Number of Buckets and Working Proportions, Performance Characteristics, Governing of Impulse Turbines. Problems | |
| 3 | **Francis Turbines**<br>Component Parts, Construction and Operation of a Francis Turbine, Governing Mechanism, Work Done by the Turbine Runner, Working Proportions and Design Parameters, Slow, Medium and Fast Runners, Degree of Reaction, Inward/Outward Flow Reaction Turbines, Performance Characteristics, Problems. | **05** |
| 4 | **Propeller and Kaplan Turbines**<br>Component Parts, Construction and Operation of a Propeller, Kaplan Turbine, Differences Between the Francis and Kaplan Turbines, Draft Tube - Its Function and Different Forms, Performance Characteristics, Governing of Reaction Turbine, Introduction to New Types of Turbine, Deriaz ( Diagonal ), Bulb, Tubular Turbines, Problems. Unit Quantities, Specific Speed and Model Relationships for Turbines, Scale Effect, Cavitations – Its Causes, Harmful Effects and Prevention, Thomas Cavitation Factor, Permissible Installation Height, Problems. | **06** |
| 5 | **Centrifugal Pumps**<br>Classification, Velocity Vector Diagrams and Work Done, Manometric Efficiency, Vane Shape, Head Capacity Relationship and Pump Losses, Pressure Rise in Impeller, Minimum Starting Speed, Design Considerations, Multi-Stage Pumps. Similarity Relations and Specific Speed, Net Positive Suction Head, Cavitation and Maximum Suction Lift, Performance Characteristics. Brief Introduction to Axial Flow, Mixed Flow and Submersible Pumps, Problems. | **06** |
| 6 | **Reciprocating Pumps**<br>Construction and Operational Details, Discharge Coefficient, Volumetric Efficiency and Slip, Work and Power Input, Effect of Acceleration and Friction on Indicator Diagram (Pressure – Stroke Length Plot), Separation, Air Vessels and their Utility, Rate of Flow into or From the Air Vessel, Maximum Speed of the Rotating Crank, Characteristic Curves, Centrifugal Vs Reciprocating Pumps, Brief Introduction to Screw, Gear, Vane and Radial Piston Pumps, Problems. | **06** |
| 7 | **Hydraulic Systems**<br>Function, Construction and Operation of Hydraulic Accumulator, Hydraulic Intensifier, Hydraulic Crane, Hydraulic Lift and Hydraulic Press, Fluid Coupling and Torque Converter, Hydraulic Ram, Problems. | **04** |

**Suggested Books:**

| **Sr.** | **Name of Book, Author, Publisher** | **Year of Publication / Reprint** |
|---|---|---|
| **Text Books** | | |
| 1 | Som S.K. and Biswas, G - Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill, New Delhi. | |
| 2 | Cengel and Cimbla (2014), Fluid Mechanics: Fundamentals and Applications, 3rd Edition, McGraw Hill Education | |
| 3 | Agrawal S. K.- Fluid Mechanics and Machinery, Tata McGraw-Hill, New | |
| 4 | Kumar, D. S. - Fluid Mechanics and Fluid Power Engineering, Kataria& Sons Publishers, New Delhi. | |
| 5 | Ramamrutham S., Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi. | |

**Course Outcome**

| **Sr** | **Course Outcome** | **CO** |
|---|---|---|
| 1 | Use the concepts of fluid mechanics to develop the understanding about energy imparted by the liquid jets. | CO1 |
| 2 | Understand the fundamentals of turbine & design of its components, and will also be able to use & produce a better design with higher efficiency. | CO2 |

| | | |
|---|---|---|
| 3 | Understand the fundamentals of pumps, and will also be able to design & develop the fluid transfer systems to meet the industry requirements. | CO3 |
| 4 | Understanding of different hydraulic systems & their applications. | CO4 |

**Course Code** : **DCC-MEP2232**
**Course Title** : **Fluid Machines Lab**
**L-T-P/S=Credits** : **0-0-2 =1**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** :
**Equal Course Code (if any)** :
**Equivalent Course Code (if any)** :

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | To study the performance characteristic test on pelton wheel turbines. |
| 2 | To study the performance characteristic test on francis turbines. |
| 3 | To study the performance characteristic test on single stage Centrifugal Pump at constant speed. |
| 4 | To study the performance characteristic test on single stage Centrifugal Pump at variable speed. |
| 5 | To study the performance characteristic test on reciprocating Pump at variable speed. |
| 6 | To study the performance characteristic test on hydraulic ram. |
| 7 | To study the performance characteristic test on a gear pump. |

**Course Code** : **DCC-MEL2113**
**Course Title** : **Manufacturing Processes**
**L-T-P/S=Credits** : **3-0-0 =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Classification of Manufacturing Processes of Materials, Casting**<br>Scope, Pattern, Pattern Allowances, Solidification, Gating and Risering, Sand Mould, Permanent Mould, Cold and Hot Chamber Die Casting, Shell Moulding, Investment Casting and Centrifugal Casting, Fettling, Casting Defects and Remedies. | **05** |
| 2 | **Forming**<br>Scope, Fundamentals of Forming, Hot & Cold Working Processes, Rolling, Extension, Wire Drawing, Forging, Fundamentals of Sheet Metal Operation, High Energy Rate Forming Processes. Powder Metallurgy - Scope, Basic Steps, Production of Powders, Powder Characteristics, Advantages and Disadvantages. | **05** |
| 3 | **Welding**<br>Scope, Classification, Fundamental of Welding, Heat Affected Zone, Welding Metallurgy andIts Effect on Performance of Weldments, Residual Stresses and Distortion of Weldments, SMAW, TIG, MIG, SAW, PAW and Gas Welding Process (Principles & Applications), Brazing and Soldering Operations. | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |

| | | |
|---|---|---|
| 1 | Kalpakjian, S. - Manufacturing Engineering and Technology, Pearson Education, Singapore | |
| 2 | Ghosh and Mallik – Manufacturing Science, East West Press Private Ltd. | |
| 3 | Rao, P. N. – Manufacturing Technology (Casting, Forming and Welding), Tata McGraw Hill, New Delhi. | |
| 4 | De Garmo, E. P. - Materials and Processes in Manufacturing, Prentice Hall of India, New Delhi. | |
| **Reference Books** | | |
| 1 | | |
| 2 | | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Select appropriate Manufacturing Processing to manufacture any component | CO1 |
| 2 | Acquire fundamental knowledge and design widely used and very important primary manufacturing processes such as casting, joining and forming | CO2 |
| 3 | Analyze the research trends in various manufacturing processes | CO3 |

**Course Code** **: DCC-MEP2113**
**Course Title** **: Manufacturing Processes Lab**
**L-T-P/S=Credits** **: 0-0-2 =1**
**Course Category** **: Engineering Course**
**Pre-requisite Courses (if any)** **:**
**Equal Course Code (if any)** **:**
**Equivalent Course Code (if any)** **:**

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | To prepare a sheet metal product. |
| 2 | To prepare a pattern for a given object for lost foam casting/sand casting. |
| 3 | To prepare a green sand mould from the prepared pattern. |
| 4 | To melt and pour aluminium metal into the mould and analyse casting defects. |
| 5 | To make a square rod from a given round rod, by hand forging operation |
| 6 | To study and observe the closed die forging techniques throughdemonstration. |
| 7 | To make a butt joint/lap using the given two M.S pieces by arc welding. |
| 8 | To make a lap joint, using the given two M.S pieces and by MIG/TIG welding. Study welding defects. |
| 9 | To prepare a butt joint with mild steel strips using brazing technique. |
| 10 | To make a welding lap joint of MS sheet using spot welding. Study welding defects. |
| 11 | To prepare the iron based composite tablet by powder metallurgy technique. Take elemental composition as iron, copper (2%) and graphite (1%) and zinc stearate (binder - 0.8%). |

**Course Code** : **DCC-MEL2016**
**Course Title** : **Strength of Materials - II**
**L-T-P/S=Credits** : **3-1-0 =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Strain Energy & Impact Loading**<br>Definitions, Expressions for Strain Energy Stored in a Body when Load is applied (I) Gradually, (II) Suddenly and (III) with Impact, Strain Energy of Beams in Bending, Beam Deflections, Strain Energy of Shafts in Twisting, Energy Methods in Determining Spring Deflection, Castigliano's & Maxwell's Theorems. | **04** |
| 2 | **Theories of Elastic Failure**<br>Various Theories of Elastic Failures with Derivations and Graphical Representations, Applications to Problems of 2- Dimensional Stress System with (I) Combined Direct Loading and Bending, and (II) Combined Torsional and Direct Loading. | **04** |
| 3 | **Unsymmetrical Bending**<br>Properties of Beam Cross Section, Product of Inertia, Ellipse of Inertia, Slope of Neutral Axis, Stresses & Deflections, Shear Center and Flexural Axis. | **03** |
| 4 | **Thin Walled Vessels**<br>Hoop & Longitudinal Stresses & Strains in Cylindrical & Spherical Vessels & their Derivations Under Internal Pressure, Wire Wounld Cylinders, Thick Cylinders & Spheres: Derivation of Lame's Equations, Radial & Hoop Stresses and Strains in Thick, and Compound Cylinders and Spherical Shells Subjected to Internal Fluid Pressure Only, Wire Wound Cylinders, Hub Shrunk on Solid Shaft. | **05** |
| 5 | **Rotating Rims & Discs**<br>Stresses in Uniform Rotating Rings & Discs, Rotating Discs of Uniform Strength, Stresses in (I) Rotating Rims, Neglecting the Effect of Spokes, (II) Rotating Cylinders, Hollow Cylinders & Solids Cylinders. | **04** |
| 6 | **Bending of Curved Bars**<br>Stresses in Bars of Initial Large Radius of Curvature, Bars of Initial Small Radius of Curvature, Stresses in Crane Hooks, Rings of Circular & Trapezoidal Sections, Deflection of Curved Bars & Rings, Deflection of Rings by Castigliano's Theorem, Stresses in Simple Chain Link, Deflection of Simple Chain Links, Problems. | **04** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Popov, E. P. - Mechanics of Materials, Prentice Hall India, New Delhi. | |
| 2 | Singer,F.P. & Pytel, A.-Strength of Materials, Harper and Row H. Kogakusha Publishers, New York. | |
| 3 | Bedi, D. S. - Strength of Materials, Khanna Book Publishing Company, New Delhi. | |
| 4 | Lehri, R.S. and Lehri, A.S.- Strength of Materials, Kataria & Sons Publishers, New Delhi. | |
| 5 | Khurmi, R. S. - Strength of Materials, Khanna Publishers, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | To recognize the concept of strain energy under axial, bending and torsional loads. | CO1 |
| 2 | To understand and apply theories of failures in predicting failure of solid materials subjected to external loading systems. | CO2 |
| 3 | To understand and apply principles related to unsymmetrical bending and shear centre. | CO3 |
| 4 | To apply and analyze concept of tension, bending and combined stresses in designing various machine components | CO4 |

**Course Code : DCC-MEL2018**
**Course Title : Dynamics of Machines**
**L-T-P/S=Credits : 3-0-0 =3**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) : ---**
**Equal Course Code (if any) : ---**
**Equivalent Course Code (if any) : ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Static Force Analysis**<br>Static Equilibrium of Mechanism, Concept of Force and Couple, Free Body Diagram, Conditions of Equilibrium, Methods of Static Force Analysis of Simple Mechanisms and Power Transmission Elements, Consideration of Frictional Forces, Determination of Forces and Couples for a Crank, Inertia of Reciprocating Parts, Dynamically Equivalent System, Analytical and Graphical Method, Inertia Force Analysis of Basic Engine Mechanism, Torque Required to Overcome Inertia and Gravitational Force of a Four Bar Linkage. | **05** |
| 2 | **Balancing**<br>Balancing of Rotating Masses in One Plane and in Several Planes, Unbalanced Forces in Reciprocating Engines, Balancing of In-Line Engines, Firing Order, Radial and V-Engines, Balancing of Machines, Balancing of Linkages, Fisher's Method of Principal Vectors, Method of Linearly Independent Vectors, Balancing of Shaking Moment. | **04** |
| 3 | **Gears**<br>Toothed Gears and Spur Gears, Types of Toothed Gears, Definitions: Pressure Angle, Path of Contact, Arc of Contact, Conditions for Correct Gearing, Forms of Teeth, Involute and Its Variants, Interference and Methods of Removal, Calculation of Minimum No. of Teeth on Pinion/Wheel for Involute Rack, Helical/Spiral/Bevel/Worm Gears. Gear Trains- Types of Gear Trains, Simple, Compound and Epicyclic Gear Trains, Problems and their Applications, Estimation of Velocity Ratio of Worm and Worm Wheel. | **06** |
| 4 | **Single Degree Vibration**<br>Natural Frequency of Free Oscillations, Equivalent System, Energy Method, Single Degree Damped Systems, Forced Vibrations, Support Isolation, Measurement of Vibrations, Critical Speed of Simple Shafts; Two and Multi Degree. Vibration –Two Degree Freedom Systems, Generalized Coordinates, Principal Coordinates, Coordinate Coupling, Lagrange's Equation, Vibration Absorbers, Multi Degree Freedom Systems-Calculation of Natural Frequencies by Matrix Methods, Stodola, Ralyeigh and Holzer Methods. | **06** |
| 5 | **Kinematic Synthesis of Mechanisms**<br>Freudenstien's Equation, Function Generation Errors in Synthesis, Two/Three Point Synthesis, Transmission Angles, Least Square Techniques. | **04** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Rao, J.S. and Dukkipati, R.V.-Mechanism and Machine Theory, Wiley-Eastern, New Delhi. | |
| 2 | Ballaney, P.L. – Theory of Machines, Khanna Publishers, New Delhi. | |
| 3 | Khurmi, R.S. and Gupta, J.K. – Theory of Machines, Eurasia Publishing House (P)Ltd, New Delhi. | |
| 4 | Ghosh, A. and Mallick A.K.- Thoery of Mechanisms and Machines, Affiliated East-West Press Pvt.Ltd.,New Delhi. | |
| 5 | Rattan, S.S.- Theory of Machines, Tata McGraw Hill, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | To equip the student with fundamental knowledge of dynamics of machines so that students can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, and vibrations. | CO1 |
| 2 | Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses. | CO2 |
| 3 | Develop understanding of vibrations and its significance on engineering design. | CO3 |
| 4 | Develop understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments. | CO4 |

**Course Code : DCC – MEP 2018**
**Course Title : Dynamics of Machines Lab**
**L-T-P/S=Credits : 0-0-2 =1**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) :**
**Equal Course Code (if any) :**
**Equivalent Course Code (if any) :**

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | To plot the follower displacement vs. angle of CAM rotation for an eccentric CAM with roller followers. |
| 2 | To determine the characteristics curve of sleeve position against speed for watt- governor and determine the characteristics curve of rotation against controlling. |
| 3 | To study the gyroscopic effect of a rotating disc. |
| 4 | To study the pressure profile of lubricating oil. |
| 5 | To measure epicyclic gear between input shaft and output shaft. |
| 6 | To study the effect of the whirling of the shaft. |
| 7 | To balance the mass static and dynamically of a single rotating mass system. |
| 8 | To study various types of gears- helical, cross helical, worm, bevel gears. |
| 9 | To study various types of dynamometers. |
| 10 | To find the moment of interia of a flywheel. |

**Course Code** : **XXL MC2XX**
**Course Title** : **Environmental Studies**
**L-T-P/S=Credits** : **3-0-0 =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **The Multidisciplinary Nature of Environmental Studies and Natural Resources** Definition; Scope and importance, Need for public awareness. Natural Resources, Renewable and non-renewable resources, Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources | **05** |
| 2 | **Ecosystems** Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem | **03** |
| 3 | **Environmental Pollutions** Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. | **04** |
| | **Social issues, Human Population and the Environment** From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Resettlement and rehabilitation of people; its problems and concerns. Population growth, Environment and human health, Human Rights, Value Education, Women and Child Welfare, Role of information Technology in Environment and human health. | **05** |
| | **Field Work** -Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.<br>- Visit to a local polluted site-urban/rural/industrial/agricultural.<br>- Study of common plants, insects, birds.<br>- Study of simple ecosystems-pond, river, hill slopes, etc. | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Bharucha E, Environmental Studies for Undergraduate Courses, 2nd Ed., University Press (India) Pvt. Ltd. 2013 | 2013 |
| 2 | Cunningham W and Cunningham M, Principles of Environmental Science, 9th Ed., McGraw-Hill Education, 2019 | 2019 |
| 3 | Sharma PD, Ecology and Environment, 13th Ed. Rastogi Publications, 2017 | 2017 |
| 4 | Gary S. and Thorpe MS, Barron's AP Environmental Science, 6th Ed., Barrons Educational Series, 2015 | 2015 |
| 5 | Romm J, Climate Change: What Everyone Needs to Know® 1st Ed., Oxford University Press, 2016 | 2016 |
| 6 | Fortey R, The Wood for the Trees: One Man's Long View of Nature, Knopf, 2016 | 2016 |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understand the basics of the environment and the impact of human activities. | CO1 |
| 2 | Understand the importance of multiple disciplines in addressing the environmental issues. | CO2 |
| 3 | Understand sustainable environmental management approaches. | CO3 |

**Semester - V**

**Course Code** : **DCC-MEL3017**
**Course Title** : **Machine Design - I**
**L-T-P/S=Credits** : **3-0-0 =3**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Introduction to design**, design and designer, objective of design, design definitions, design process, System design versus component design, Introduction to behaviour of mechanical systems, transformation of customer requirements into design artefacts, functional and structural hierarchies, functional and structural hierarchies of Gear, Engine, etc. Various types of loading in mechanical systems, stress concentration, endurance limit, S N and SNP diagrams. Variable Loading: Different Types of Fluctuating/ Variable Stresses, Fatigue Strength Considering Stress Concentration Factor, Surface Factor, Size Factor, Reliability Factor, etc., Fatigue Design for Finite and Infinite Life against Combined Variable Stresses using Goodman and Soderberg's Criterion, Fatigue Design using Miner's Equation, Design Problems on above. | **06** |
| 2 | **Stress concentration** and its mitigation, manufacturing consideration in design, standardization, tolerances and fits, BIS code –IS-919, manufacturing processes, Design of shafts and couplings. Rigidity and deflection Consideration. | **04** |
| 3 | **Springs**<br>Types of springs, Design for Helical Springs against Tension and their Uses, Compression and Fluctuating Loads, Design of Leaf Springs, Surging Phenomenon in springs, Design Problems.<br>Bearings: Design of Pivot and Collar Bearing, Selection of Ball and Roller Bearing Based on Static and Dynamic Load Carrying Capacity Using Load-Life Relationship, Selection of Bearings From Manufacturer's Catalogue. | **05** |
| 4 | **Permanent Joint**<br>Riveted joints- Rivet materials, Rivet heads, leak proofing of riveted joint – caulking and fullering. Methods of failure of riveted joints- strength equations-efficiency of riveted joints-eccentrically loaded riveted joints. Design of riveted joint – Lap and butt, single and multi-riveted joint.<br>Welded joints- Welding symbols, Type of welded joint, strength of parallel and transverse fillet welds. Strength of combined parallel and transverse weld, Welded joints under eccentric loading. | **05** |
| 5 | **Gear Design**<br>Classification of gears, Selection of type of gears, Law of Gearing, Gear terminology, Standard system of gear tooth, force analysis, Interference and undercutting, number of teeth, gear tooth failures, selection of material.<br>Spur and Helical Gears: Stress in gear tooth: Lewis's formula, AGMA bending stress equation and AGMA pitting resistance formula, Gear quality and selection aspects.<br>Bevel and Worm gears: Specifications and design of bevel and worm gears. | **07** |
| 6 | **Belts & Pulleys**<br>Transmission of power by Belt and Rope Drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drive, Design of chain drive, selection from catalogue, silent chain | **05** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|

| Text Books | | |
|---|---|---|
| 1 | Bhandari, V. B. -Design of Machine Elements, Tata McGraw Hill, New Delhi. | |
| 2 | Ullman D.G., "The Mechanical Design process", 3rd edition, McGraw Hill, 2009. | 2009 |
| 3 | Mott, R.L, "Machine Elements in Mechanical Design", 4th edition, Prentice Hall, Singapore, 2005. | 2005 |
| 4 | Shigley, J.E., Mischke, C. Brown T., "Standard Hand book of Machine Design" McGraw Hill. | |
| 5 | Shigley, J.E. and Mischke - Mechanical Engineering Design, McGraw Hill, New York. | |
| 6 | Shigley, J.E., "Hand Book of Machine Design", McGraw Hill, 2004. | 2004 |
| 7 | Motts, R.L – Machine Elements in Mechanical Design, 3RD Ed., McMillan Publishing House. | |
| 8 | Sharma, P. C. and Aggarwal, D. K. – Machine design, Kataria& Sons Publishers, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | The students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of machine components. | CO1 |
| 2 | Describe the fundamentals of design for static and variable loading. | CO2 |
| 3 | To understand and apply principles of gear design to spur gears and industrial spur gear boxes. | CO3 |
| 4 | To learn a skill to design helical, bevel gear & worm gear box for various industrial applications. | CO4 |
| 5 | To inculcate an ability to design belt drives and selection of belt, rope and chain drives. | CO5 |

**Course Code : DCC-MEL3021**
**Course Title : CAD/ CAM**
**L-T-P/S=Credits : 3-0-0 =3**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) : ---**
**Equal Course Code (if any) : ---**
**Equivalent Course Code (if any) : ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Fundamentals of CAD**<br>Introduction, Design Process, Application of Computers in Design, Benefits of CAD, Computer Hardware, Graphic Input Devices, Display Devices, Graphics Output Devices, CAD Software and Database, Software Configuration of a Graphic System, Functions of a Graphic Package, Geometric Modeling, Database Structure and Control, Graphic Standards such as GKS and IGES. | **06** |
| 2 | **Geometric Transformations**<br>Mathematics Preliminaries, Matrix Representation of 2 and 3 Dimensional Transformation, Concatenation of Transformation Matrices, Application of Geometric Transformations, Representation of Curves and Surfaces: Polygon, Meshed and Ruled Surfaces, Bezier Curves, B-Spline Curves. | **05** |
| 3 | **Geometric Modeling**<br>Wireframe Modeling, Solid Modeling Representation, Volumetric Properties, Surface Modeling, Concept of Hidden-Line Removal and Shading, Kinematics Analysis and Simulation. | **05** |
| 4 | **CNC Machine Tools**<br>Development of CNC Technology, Principles, Features, Advantages, Economic Benefits, Applications, CNC, DNC Concept, Classification of CNC Machines, Types of Control, CNC | **05** |

| | | |
|---|---|---|
| | Controllers, Characteristics, Interpolators. | |
| 5 | **Drives and Controls**<br>Spindle Drives, Feed Drives, Open Loop and Closed Loop Control, Axis Measuring Systems. Tooling and Maintenance of CNC Machine Tools. | **04** |
| 6 | **CNC Programming**<br>Coordinate System, Structure of a Part Program, G & M Codes, Manual Part Programming for Fanuc, Heidenhain, Numeric Control Systems, APT Part Programming, Programming Exercises. Computer Aided Process Planning – Retrieval, Generative and Hybrid Approaches, Advantages, Case Studies. | **05** |

**Suggested Books:**

| **Sr.** | **Name of Book, Author, Publisher** | **Year of Publication / Reprint** |
|---|---|---|
| **Text Books** | | |
| 1 | Groover, M. P. and Zimmers, E. W. - CAD/CAM, Prentice Hall of India, New Delhi. | |
| 2 | Zeid, I. - CAD/CAM - Theory and Practice, Tata McGraw Hill, New Delhi. | |
| 3 | Rao, P. N. – CAD/CAM, Tata McGraw Hill, New Delhi. | |
| 4 | Groover. M. P. - Automation, Production Systems and computer Integrated Manufacturing, Pearson Education Asia, New Delhi. | |
| 5 | Reddy, J. N.-An Introduction to the Finite Element Method, McGraw Hill, New York. | |
| 6 | Pham, D.T. and Dimov, S.S. - Rapid Manufacturing, Springer Verlag | |
| 7 | Ranky, P. G. -Computer Integrated Manufacture, Prentice-Hall | |

**Course Outcome**

| **Sr** | **Course Outcome** | **CO** |
|---|---|---|
| 1 | The students will be aware of the developments in various Input and Output Devices used in designing and manufacturing and also understand their advancements. | CO1 |
| 2 | The students will be able to apply appropriate transformation algorithms, develop models and would be aware of the processes and methods of model generation on computers. | CO2 |
| 3 | The students will be able use and understand the different CAE software's available in the market. | CO3 |
| 4 | The students will understand the working of a numeric control machine and be aware of its components and their respective importance. They would also be able to differentiate between the conventional and NC machine | CO4 |
| 5 | The students will be able to understand and generate the various NC codes for different processes. | CO5 |
| 6 | The students will be able to take safety, environmental and other issues into consideration while designing a component. They would become aware of the purpose of adapting Automation in an industry | CO6 |

**Course Code : DCC – MEP 3021**
**Course Title : CAD/ CAM Lab**
**L-T-P/S=Credits : 0-0-2 =1**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) :**
**Equal Course Code (if any) :**
**Equivalent Course Code (if any) :**

**List of Experiments**

| **Sr** | **Contents** |
|---|---|

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|---|---|
| 1 | **Section – A**<br>Exercises in Modeling and Analysis of various types of Mechanical Components and Assemblies using Parametric and feature based Packages like PRO-E / SOLID WORKS /CATIA /ANSYS / NASTRAN, etc. At least 15 components and assemblies should be modeled and analyzed by the students using the above packages in the laboratory during the semester. |
| 2 | **Section – B**<br>The following practical exercises are to be carried out:<br>1. Study of the structure of a CNC turning centre<br>2. Study of the structure of a CNC machining centre<br>3. Part-Programming on the above CNC machines and execution of part programs for Machining given profiles (at least 10 different jobs).<br><br>(i) Manual Part Programming for CNC Machines using G and M codes, simulation of Tool Path<br>(ii) Computer Assisted Part Programming using APT language<br><br>4. Exposure to component modelling and CL data generation using CAD/CAM Software like Unigraphics, Pro/E, Smart CAM, etc.<br>5. NC code generation using CAD/CAM software - post processing for standard CNC controls like FANUC, SINUMERIC, etc. |
| | |

**Course Code** **: MEL DC305**
**Course Title** **: Artificial Intelligence and Machine Learning**
**L-T-P/S=Credits** **: 3-0-0 =3**
**Course Category** **: Engineering Course**
**Pre-requisite Courses (if any)** **: ---**
**Equal Course Code (if any)** **: ---**
**Equivalent Course Code (if any)** **: ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Introduction to AI & ML**<br>History of AI, Comparison of AI with Data Science, Need of AI in Mechanical Engineering, Introduction to Machine Learning. Basics: Reasoning, problem solving, Knowledge representation, Planning, Learning, Perception, Motion and manipulation. Approaches to AI: Cybernetics and brain simulation, Symbolic, Sub-symbolic, Statistical. Approaches to ML: Supervised learning, Unsupervised learning, Reinforcement learning. | **05** |
| 2 | **Feature Extraction and Selection**<br>Feature extraction: Statistical features, Principal Component Analysis. Feature selection: Ranking, Decision tree - Entropy reduction and information gain, Exhaustive, best first, Greedy forward & backward, Applications of feature extraction and selection algorithms in Mechanical Engineering. | **05** |
| 3 | **Classification & Regression**<br>Classification: Decision tree, Random forest, Naive Bayes, Support vector machine. Regression: Logistic Regression, Support Vector Regression. Regression trees: Decision tree, random forest, K-Means, K-Nearest Neighbor (KNN). Applications of classification and regression algorithms in Mechanical Engineering. | **04** |
| 4 | **Development of ML Model**<br>Problem identification: classification, clustering, regression, ranking. Steps in ML modeling, Data Collection, Data pre-processing, Model Selection, Model training (Training, Testing, K-fold Cross Validation), Model evaluation (understanding and interpretation of confusion matrix, Accuracy, Precision, Recall, True positive, false positive etc.), Hyper parameter Tuning, Predictions. | **05** |
| 5 | **Reinforced and Deep Learning**<br>Characteristics of reinforced learning; Algorithms: Value Based, Policy Based, Model Based; Positive vs Negative Reinforced Learning; Models: Markov Decision Process, Q Learning. Characteristics of Deep Learning, Artificial Neural Network, Convolution | **05** |

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|---|---|---|
| | Neural Network. Application of Reinforced and Deep Learning in Mechanical Engineering. | |
| 6 | **Applications**<br>Human Machine Interaction, Predictive Maintenance and Health Management, Fault Detection, Dynamic System Order Reduction, Image based part classification, Process Optimization, Material Inspection, Tuning of control algorithms. | **04** |

**Suggested Books:**

| **Sr.** | **Name of Book, Author, Publisher** | **Year of Publication / Reprint** |
|---|---|---|
| **Text Books** | | |
| 1 | Deisenroth, Faisal, Ong, Mathematics for Machine Learning, Cambridge University Press, 2020. | |
| 2 | B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020. | |
| 3 | Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015 | |
| 4 | Stuart Russell and Peter Norvig (1995), "Artificial Intelligence: A Modern Approach," Third edition, Pearson, 2003. | |

**Course Outcome**

| **Sr** | **Course Outcome** | **CO** |
|---|---|---|
| 1 | DEMONSTRATE fundamentals of artificial intelligence and machine learning. | CO1 |
| 2 | APPLY feature extraction and selection techniques. | CO2 |
| 3 | APPLY machine learning algorithms for classification and regression problems. | CO3 |
| 4 | DEVISE AND DEVELOP a machine learning model using various steps. | CO4 |
| 5 | EXPLAIN concepts of reinforced and deep learning. | CO5 |
| 6 | SIMULATE machine learning model in mechanical engineering problems. | |

**Semester 6**

**Course Code : MEL-DC302**
**Course Title : Manufacturing Processes II**
**L-T-P/S=Credits : 2-0-2 =3**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) : ---**
**Equal Course Code (if any) : ---**
**Equivalent Course Code (if any) : ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Machining Processes:** Introduction, History of machining, Scope and significance of machining. Types of motions in machining operations turning, boring, shaping, planing drilling and milling, broaching and grinding etc. Machining parameters, Cutting Speed, Feed and Depth of Cut and related quantities. [Sketches pertaining to relative motions between tool and work piece only] | **04** |
| 2 | **Cutting Tool Materials & Cutting Fluids:** Introduction, Characteristics of Tool Materials, Various Types of Cutting Tool Materials, Coated Tools, Cutting Tool Selection, Single point cutting tool geometry. Purpose and Types of Cutting Fluids, Basic Actions of Cutting Fluids, Effect of Cutting Fluid on Tool Life | **04** |
| 3 | **Mechanics of Metal Cutting:** Introduction, Deformation of Metal During Machining, Mechanics of Chip Formation, Types of Chip, Mechanics of Orthogonal and Oblique Cutting, Merchant Cutting Force Circle and Shear Angle Relationship in Orthogonal cutting, Temperature Distribution , Tool Chip Interface. Numericals on Cutting Forces and Merchant Circle. | **05** |
| 4 | **Machine Tools:** Introduction, Classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, shaping machine, planing machine, grinding machine [Simple sketches showing major parts of the machines] | **04** |
| 5 | **Tool Wear and Tool Life:** Introduction, Tool wear mechanism, Tool life equations, Effect of process parameters on tool life, Machinability, Numerical problems on tool life. Economics of Machining Processes. | **04** |
| 6 | **Gear Manufacturing:** Introduction, Methods of Manufacture, Gear Generation and Forming: Gear Cutting by Milling, Single Point Form Tool, Gear Hobbing. Gear Finishing Operations: Gear Shaving, Gear Grinding, Lapping. | **04** |
| 7 | **Non-Conventional Machining Processes:** Abrasive Jet Machining: Principles, Applications, Process Parameters. Ultrasonic Machining: Principles, Applications, Analysis of Process Parameters. Electric Discharge Machining: Principles, Selection of Tools Materials and Dielectric Fluid. Electron Beam Machining: Generation of Electron Beam, Relative Merits and Demerits. Laser Beam Machining: Principles and Applications. | **05** |
| 8 | **CNC Machining:** CNC Types, machining centre and part programming fundamentals of CNC machine. | **03** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | M. C. Shaw, Metal cutting-Principles and Practices, Cambridge University press. 2005 2. | 2005 |
| 2 | Rao PN, Manufacturing Technology–Metal Cutting and Machine Tools, 3/e, TMH, New Delhi, 2013. 3. | 2013 |
| 3 | Bhattacharya A, Metal Cutting: Theory and Practice, New Central Book Agency, | 2007 |

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|---|---|---|
| | Kolkata, 2007 4. | |
| 4 | Winston A. Knight and Geoffrey Boothroyd, Fundamentals of Machining and Machine Tools, 3/e, Taylor & Francis Group, 2005. 5. | 2005 |
| 5 | Trent, E. M. and P. K. Wright, Metal Cutting, 4th edition., Butterworth-Heinemann, 2000 | 2000 |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understand the tool nomenclature and cutting forces | CO1 |
| 2 | Have the knowledge on tool materials, tool life and tool wear. | CO2 |
| 3 | Understand the gear manufacturing and advanced machining processes. | CO3 |

**Course Code : DCC-MEL3221**
**Course Title : Heat and Mass Transfer**
**L-T-P/S=Credits : 3-0-0 =3**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) : ---**
**Equal Course Code (if any) : ---**
**Equivalent Course Code (if any) : ---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Modes of Heat Transfer**<br>Conduction-Fourier's Law, Thermal Conductivity of Solids, Liquids and Gases, Factors influencing Thermal Conductivity, General Three Dimensional Heat Conduction Equation in Cartesian, Cylindrical and Spherical Co-ordinates, Heat Flow through Plane Walls, Cylinders and Spheres, Heat Source Systems, Plane Wall and Cylinder, Critical Thickness of Insulation, Different Types of Fins, Heat Transfer from Fins of Uniform Cross Section, Heat Flow in a Semi Infinite Solid with Sudden Change of Surface Temperature, Periodic Variation of Surface Temperature. | **07** |
| 2 | **Convection**-Free and Forced Convection, Basic Concepts of Hydrodynamic and Thermal Boundary Layers, Similarity Conditions of Heat Transfer Processes, Equations of Motion and Energy, Application of Dimensional Analysis, Empirical Equation of Convective Heat Transfer-Reynolds Analogy, Fundamentals of Boiling Heat Transfer, Pool Boiling, Heat Transfer in Condensation, DropWise and Film Condensation, Emperical Equations. | **05** |
| 3 | **Radiation**<br>Thermal Radiation, Monochromatic and Total Emissive Power Absorptivity, Reflectivity and Transmissivity, Black, Grey and Real Surfaces, Planck's Distribution-Law, Wien's Displacement Law, Stefan- Boltzmann's Law, Kirchhoff's Law, Heat Transfer by Radiation between Black Surface and Grey Surfaces, Heat Transfer in Presence of Re-Radiating Surface, Electrical Network Method of Solving Radiation Problems, Radiation Shields, Shape Factors. | **06** |
| 4 | **Heat Exchangers**<br>Basic Type of Heat Exchangers, Fouling Factor, Overall Heat Transfer Co-efficient, Logarithmic Mean Temperature Difference (LMTD), Effectiveness-NTO Methods of Design of Single and Multiple Pass Heat Exchangers. | **05** |
| 5 | **Mass Transfer**<br>Rate Equations, Mass Diffusion in Binary Mixtures, Evaporation in a Column, | **04** |

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|---|---|---|
| | Forced Convective Mass Transfer, Heat and Mass Transfer Analogies. | |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Yadav, R.-Heat and Mass Transfer, Central Publishing House, Allahabad. | |
| 2 | Sachdeva, R. C. Fundamentals of Engineering Heat and Mass Transfer, New Age International Publishers, New Delhi. | |
| 3 | Holman J.P.- Heat and Mass Transfer, Tata McGraw Hill, New Delhi. | |
| 4 | Ozisik, M. N.- Heat Transfer, McGraw Hill, New York. | |
| 5 | Kothandaraman, C.P.- Fundamentals of Heat and Mass Transfer, New Age International Publishers, New Delhi. | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | Understanding the phenomenological origin of Fourier's law. Solve the general heat conduction equation for one-dimensional, steady-state problems. Each student can also analyze extended surfaces (fins). | CO1 |
| 2 | Understanding the physical phenomena associated with convection, Newton's law of cooling, and the significance of non-dimensional parameters in convection heat transfer. Use empirical correlations to analyse external and internal, forced and free convection problems. | CO2 |
| 3 | Understanding the physical mechanisms involved in radiation heat transfer. Analyze the radiative heat exchange between surfaces and in diffuse, gray enclosures. | CO3 |
| 4 | Understand types of heat exchangers overall heat transfer coefficient for a heat exchanger. Use the Log mean temperature difference (LMTD) and Number of Transfer Units (NTU) method for parallel and counter-flow operation. | CO4 |
| 5 | To understand the physical mechanism of mass transfer by convection. To memorize and understand the mass conservation equation and mass diffusion equation | CO4 |

**Course Code : DCC-MEP3221**
**Course Title : Heat and Mass Transfer Lab**
**L-T-P/S=Credits : 0-0-2 =1**
**Course Category : Engineering Course**
**Pre-requisite Courses (if any) :**
**Equal Course Code (if any) :**
**Equivalent Course Code (if any) :**

**List of Experiments**

| Sr | Contents |
|---|---|
| 1 | To Determine the Thermal Conductivity of a Metallic Rod. |
| 2 | To Determine the Thermal Conductivity of an Insulating Power. |
| 3 | To Determine the Thermal Conductivity of a Solid by Guarded Hot Plate Method. |
| 4 | To Find the Effectiveness of a Pin Fin in a Rectangular Duct Natural Convective Condition and to Plot Temperature Distribution along its Length. |
| 5 | To Find the Effectiveness of a Pin Fin in a Rectangular Duct Under Forced Convective and to Plot Temperature Distribution along its Length. |
| 6 | To Determine the Surface Heat Transfer Coefficient for a Heated Vertical Tube under Natural Convection and to Plot the Variation of Local Heat Transfer Coefficient along the Length of the Tube. Also Compare the Results with those of the Correlation. |
| 7 | To Determine Average Heat Transfer Coefficient for an Externally Heated Horizontal Pipe under Forced Convection & to Plot Reynolds and Nusselt Numbers along the Length of Pipe. Also Compare the Results with those of the Correlations. |

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|---|---|
| 8 | To Measure the Emmisivity of the Gray Body (Plate) at Different Temperature and to Plot the Variation of Emmisivity with Surface Temperature. |
| 9 | To Find Overall Heat Transfer Coefficient and Effectiveness af a Heat Exchanger under Parallel and Counter Flow Conditions. Also Plot the Temperature Distribution in both the cases along the Length of Heat Exchanger. |
| 10 | To Verify the Stefen-Boltzmann Constant for Thermal Radiation. |
| 11 | To Demonstrate the Super Thermal Conducting Heat Pipe and Compare its working with that of the Best Conductor i.e., Copper Pipe. Also Plot Temperature Variation along the Length with Time or Three Pipes. |
| 12 | To Study the Two Phases Heat Transfer Unit. |
| 13 | To Study Cross Flow Type Heat Exchanger (Air To Air). |

**Semester - VII**

**Course Code** : **DCC-MEL3221**
**Course Title** : **Industrial Engineering**
**L-T-P/S=Credits** : **3-1-0 =4**
**Course Category** : **Engineering Course**
**Pre-requisite Courses (if any)** : **---**
**Equal Course Code (if any)** : **---**
**Equivalent Course Code (if any)** : **---**

**Detailed Syllabus**

| Sr | Contents | Approx. Contact Hours |
|---|---|---|
| 1 | **Introduction**: Introduction to Productivity, Industrial engineering: Functions of Industrial engineering, principles of Industrial engineering, Role of an Industrial Engineer in Industry | **04** |
| 2 | **Production Planning and Control**: Functions, Forecasting techniques: Qualitative and Quantitative- Naïve, Moving average, weighted moving average, exponential smoothing; Scheduling and Sequencing; Inventory Control: Different costs, Economic Order Quantity- different models, Selective Inventory Control- ABC, VED, FSN models | **06** |
| 3 | **Plant Layout and Material Handling**: Importance, Different Types of Layouts Viz. Product, Process and Combination Layouts, Types of Material handling equipments | **03** |
| 4 | **Work study:** Introduction and Importance, Basic procedures of Work Study, Method Study: Objective, Recording techniques- Process charts and Diagrams, Various Charting Techniques, Use and Applications, Techniques, Principles of motion economy, Work Measurement Techniques, Time study Objective, Work sampling, methods of rating, standard time calculations, Predetermined Motion time studies, | **05** |
| 5 | **Ergonomics:** Objectives and scope, Importance of Ergonomics in workplaces, Man-Machine system, Human Factors in the Application of Work Study | **02** |

**Suggested Books:**

| Sr. | Name of Book, Author, Publisher | Year of Publication / Reprint |
|---|---|---|
| **Text Books** | | |
| 1 | Hope, and Spearman- Factory Physics, McGraw-Hill Education | |
| 2 | Telsang, M. T.-Industrial Engineering and Production Management, S Chand | |
| 3 | Kale, S.-Production and Operation management, McGraw-Hill Education | |

**Course Outcome**

| Sr | Course Outcome | CO |
|---|---|---|
| 1 | The student will be able to develop simplified manufacturing processes with the aim of improving productivity while reducing the cost and manpower | CO1 |
| 2 | The student will be able to develop appropriate layout, material handling facilitates, and inventory level for manufacturing systems | CO2 |
| 3 | The student will be able to develop an ergonomically design man machine interface for manufacturing systems | CO3 |