

## **Branch Specific Courses for Mechanical Engineering Department**

### **Fundamental of Thermal and Fluid Engineering**

**MEME 102 S1**

**Scheme**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>3</b>	<b>0</b>	<b>2</b>	<b>04</b>

- **INTRODUCTION TO THERMODYNAMICS (12 Hours)**  
Classical thermodynamics & statistical thermodynamics, Thermodynamic system, properties, states, processes, cycle, equilibrium, Zeroth law of thermodynamics, Definition of work & heat and their evaluation for various thermodynamics processes, P-V-T behavior of a pure substance, Critical & triple point of a pure substance, Mollier diagram, Determination of dryness fraction of steam, Equation of state for ideal gas, Change in entropy, internal energy, enthalpy of gas in various thermodynamics processes. First law of thermodynamics for flow and non-flow processes, Application of first law of thermodynamics to boilers, engines, turbines, and compressors
- **INTRODUCTION TO FLUID MECHANICS (12 Hours)**  
Classification of fluids, Properties of fluids, Types of fluid flow, Static forces on surfaces, buoyancy and metacenter, Motion of fluid particles and streams, Continuity equations for 2-D and 3-D flow in Cartesian coordinates.
- **FUELS AND LUBRICANTS (04 Hours)**  
Classification of fuels, Calorific values of fuels, Dulong's formula, Proximate and ultimate analysis of fuel, Types of lubricants, Properties of lubricants, flash point, fire point, viscosity, vapor pressure, cloud point, pour point, etc.
- **STEAM GENERATORS (04 Hours)**  
Steam generators, Definition, Classification, General study of Cochran, Babcock Wilcox, Lancashire and Benson boilers, boilers mountings and accessories, Types of draught, Calculation of chimney height, boiler efficiency and numericals, Layout of thermal power plant.
- **INTERNAL COMBUSTION ENGINES (05 Hours)**  
Air standard cycles: Otto cycle, Diesel cycle, and Dual cycle with numericals, Classification of internal combustion engines, Spark ignition and compression ignition engines, two-stroke and four-stroke engines, various efficiencies.
- **REFRIGERATION AND AIR-CONDITIONING (05 Hours)**  
Unit of refrigeration, Coefficient of performance, Refrigerants, Vapour Compression refrigeration system, Domestic refrigerator, Psychrometric terms, Window and split air conditioners, Central air conditioning systems, Ice plant.

**(Total Lecture Hours: 42)**

### **PRACTICALS:**

1. Determination of calorific value of solid fuels by Bomb Calorimeter
2. Determination of flash point and fire point of a given sample of oil.
3. Determination of viscosity of oil by viscometer (Redwood or Saybolt).
4. Study of working of 2-stroke and 4-stroke SI and CI engines
5. Study of different types of steam generators
6. Study of mountings and accessories of steam generators
7. Study of working of refrigerator and air conditioner
8. Study and determination of COP of ice plant
9. Determination of different types of flow patterns by Reynolds's experiment.
10. Determination of metacentric height of floating body.

**BOOKS RECOMMENDED:**

1. P. K. Nag. Engineering thermodynamics, 6<sup>th</sup> Edition, McGraw Hill, 2017.
2. R. K. Rajput. Thermal Engineering, 10<sup>th</sup> Edition, Laxmi Publications, 2018.
3. G. Rogers and Y. Mayhew. Engineering thermodynamics: work and heat transfer, 4<sup>th</sup> Edition, Pearson Education India, 2002.
4. S. K. Som, G. Biswas and S. Chakraborty. Introduction to fluid mechanics and fluid machines, 3<sup>rd</sup> Edition, McGraw Hill, 2017.
5. D. S. Kumar. Fluid mechanics and fluid power engineering, S. K. Kataria and Sons, 2013.

## Fundamental of Materials and Manufacturing

**MEME 113 S2**

**Scheme**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>3</b>	<b>0</b>	<b>2</b>	<b>04</b>

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- **ENGINEERING MATERIALS** (14 Hours)  
Classification of engineering materials, Metals (ferrous and non-ferrous) and alloys, Ceramics, Polymers (thermosets and thermoplastics), Composites (metal-matrix, ceramic-matrix, polymer-matrix), Semi-conductors, Bio-materials, Nano-materials, and Advance materials, Engineering properties of materials, Stress- Strain relationship, Effect of temperature on properties of materials.  
Crystalline structure, Nano-crystalline structure, Types of crystal systems, Crystal lattice, Lattice parameters, Metallic structures, Miller indices, Atomic radius & atomic packing factors for various crystal systems, Crystalline materials, Amorphous materials, Structure determination by X-ray diffraction, Bragg's law.
  - **METAL CASTING PROCESSES** (10 Hours)  
Overview of casting processes, Applications – materials and products, Sand casting process – types of patterns, pattern allowances, core and mould making, molding materials, types of cores, elements of riser and gating system, melting and pouring, cleaning of castings, casting defects, Special casting techniques such as – permanent mould casting, shell mould casting, die casting, investment casting, continuous casting and centrifugal casting.
  - **METAL FORMING PROCESSES** (8 Hours)  
Overview of metal forming processes, Applications - materials and products, Nature of plastic deformation, Temperature in metal forming, Forming processes - Rolling, Forging, Extrusion, Drawing (wire, bar and tube), and Sheet metal forming.
  - **WELDING AND ALLIED PROCESSES** (10 Hours)  
Overview of welding processes, Weld joints, Gas welding (Principles of gas welding, types of gases used, types of flames, welding techniques, equipment used, filler rods), Gas cutting, Electric arc welding processes - manual metal arc welding, flux cored arc welding, gas tungsten arc welding (GTAW), gas metal arc welding (GMAW), submerged arc welding, Electric resistance welding processes – spot welding, seam welding, projection welding, upset welding, flash welding, Solid state welding processes – friction welding, friction stir welding, ultrasonic welding, Weld defects, Allied processes like brazing, soldering and adhesive bonding.

**(Total Lecture Hours: 42)**

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### BOOKS RECOMMENDED:

1. M. P. Groover, Fundamentals of Modern Manufacturing, Materials, Processes, and Systems, 4<sup>th</sup> Edition, John Wiley, 2010.
2. S. Kalpakijan and S. R. Schmid, Manufacturing Processes for Engineering Materials, 6<sup>th</sup> Edition, Pearson Education, 2018.
3. P. N. Rao, Manufacturing Technology – Vol. 1, 5<sup>th</sup> Edition, McGraw Hill, 2018.
4. V. Raghavan, Materials Science and Engineering: A First Course, 6<sup>th</sup> Edition, Prentice Hall India, 2015.
5. J. T. Black and R. A. Kohser, DeGarmo's Materials and Processes in Manufacturing, Wiley India, 2017.

### **Experiments to be performed**

1. Testing of clay content of moulding sand.
2. Determination of grain fineness number of moulding sand.
3. Determination of moisture content of moulding sand.
4. Demonstration of permanent mould casting process
5. Demonstration and practice on manual metal arc welding
6. Demonstration of the effects of the welding parameters on GTAW process
7. Demonstration and practice on oxy-acetylene gas welding
8. Demonstration of the effects of the welding parameters on oxy-acetylene gas welding
9. Demonstration and practice on gas cutting
10. Practice on soldering of galvanized steel
11. Demonstration of selected forming operations