MATERIALS SCIENCE

Subject Code :15MA32	IA Marks :20
Hours/Week :04, No. of Credits:04	Exam Hours :03
Total Hours :52	Exam Marks :80

Common to 15ME32

THERMODYNAMICS

Subject Code :15MA33	IA Marks :20
Hours/Week :03 L + 02 T, No. of Credits:04	Exam Hours :03
Total Hours :52	Exam Marks :80

COURSE OBJECTIVES

The course intends to:

1. Impart fundamental concepts and laws of thermodynamics
2. Study PV and TS diagrams for various thermodynamic cycles
3. Make students understand entropy changes and write Tds relation.
4. Provide knowledge of phase changes in water
5. Introduce the concepts of refrigeration, psychrometry and air conditioning system.

COURSE OUTCOMES

After completion of course students are able to

1. Apply the laws of thermodynamics in analysis of thermodynamic systems.
2. Use PV and TS diagrams for analysis of different thermodynamic processes.
3. Evaluate entropy changes
4. Calculate enthalpy of water at its different phases
5. Calculate the refrigeration and air conditioning loads

COURSE OUTCOMES

UNIT - 1

Fundamental Concepts & Definitions: Thermodynamics definition. Characteristics of system boundary and control surface, examples. Thermodynamic properties - definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic processes; Thermodynamic equilibrium; Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

Work and Heat: Thermodynamic definition of work; examples, sign convention, p-v diagrams.

10 Hours

UNIT – 2

First Law of Thermodynamics: Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes. Specific heat at constant volume, enthalpy, specific heat at constant pressure, important applications.

Second Law of Thermodynamics: Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irrevesible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles. **10 Hours**

UNIT - 3

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

Vapour Power Cycles: Carnot vapour power cycles, Simple Rankine cycle, T- S diagram, comparison of Carnot and Rankine cycles.

10 Hours

UNIT – 4

Entropy: Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, calculation of entropy using Tds relations.

Pure Substances: P-T and P-V diagrams, triple point and critical points. Subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), Steam tables and its use.

10 Hours

UNIT - 5

Refrigeration: Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system. Calculation of refrigeration load with examples.

Psychometry: Atmospheric air and psychometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidities. Construction and use of psychometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Summer and winter air conditioning. Calculation of air conditioning load with examples.

10 Hours

TEXT BOOKS:

1. Basic and Applied Thermodynamics, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002
2. Applied Thermodynamics, Rajput, Laxmi Publication
3. Fundamentals of Classical Thermodynamics, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.

REFERENCE BOOKS:

1. Thermodynamics, An Engineering Approach, Yunus A.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002

2. Engineering Thermodynamics, J.B.Jones and G.A.Hawkins, John Wiley and Sons.

3. An Introduction to Thermodynamcis, Y.V.C.Rao, Wiley Eastern, 1993,

4. B.K Venkanna, Swati B. Wadavadagi “Basic Thermodynamics, PHI, New Delhi, 2010

Data Hand Book:

1. Thermodynamic data hand book, B.T. Nijaguna.

2. Properties of Refrigerant & Psychometric (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroiya, Birla Pub. Pvt. Ltd., Delhi, 2008

MECHANICS OF MATERIALS

Subject Code	:15MA34	IA Marks	:20
Hours/Week	:03L+02T, No. of Credits:04	Exam Hours	:03
Total Hours	:52	Exam Marks	:80

Common to 15ME34

FOUNDRY TECHNOLGY

Subject Code :15MA35	IA Marks :20
Hours/Week :04 L, No. of Credits:04	Exam Hours :03
Total Hours :52	Exam Marks :80

Course Objectives:

This course provides:

1. A basic understanding of foundry practice and metal casting as one of the important manufacturing processes.
2. An explanation of the fundamental process of solidification of pure metals and alloys.
3. Sand molding and permanent die molding are explained in detail.
4. The standard foundry practices for casting of ferrous and non-ferrous alloys elaborated.
5. An overview of the designing of molds, casting defects, inspection and testing of castings and modernization of foundries

Course outcomes:

The student shall:

1. Have an Understand the technology, variables and complexity involved in producing a casting.
2. Be able to make selection of the type of furnace required for any specific casting problem and design the pattern requirement.
3. Have the basic knowledge for selecting the type of sand, for molds and cores as well as the molding process.
4. Know about the special molding processes and when their use is warranted.
5. Have a broad knowledge of casting of ferrous and non-ferrous alloys and of the inspection techniques to detect casting defects.

UNIT-1

Introduction: Introduction to casting process and the steps involved; Components produced by casting process, Comparison of metal casting with metal joining, Advantages and limitations of casting process; Overview of the industry

Solidification of metals: Introduction, freezing of pure metals; Nucleation and Growth, shrinkage, solidification of alloys; dendritic growth and segregation; shrinkage in alloys; Alloys freezing in two stages; solidification process in eutectic and non-eutectic alloys; Properties related to the solidification mechanism – Fluidity, Hot tearing or hot cracking, Evolution of dissolved gases, Effect of inoculation; Solidification of actual castings; Progressive and directional solidification; Centerline feeding resistance; Rate of solidification; Chvorinov's Rule.

(11 Hours)

UNIT-2

Foundry Furnaces: Types of foundry furnaces – crucible, pot and reverberatory furnace; Cupola; Electric arc furnace, Induction furnace.

Patterns and pattern making: Definition, functions; Materials used for patterns, pattern allowances and their significance; Classification of patterns; BIS colour coding of patterns, Core boxes. . (10 Hours)

UNIT-3

Sand molding: Types and requirements of base sand; Binders and additives used – types and properties; Molding tools and equipment – hand molding tools, molding machines – Jolt type, squeeze type, Jolt and Squeeze type and Sand slinger; Cores – types, core prints, core venting and baking, core shifting and chaplets, method of making cores, binders used, core sand molding; Gating systems - principles and types of gates and risers, gating ratios and chills, riser location and design in actual casting; Molding processes – bench molding, floor molding, pit molding, stack molding, green sand molding, dry sand molding, loam molding, machine molding.

(10 Hours)

UNIT-4

Special Molding Processes: Study of important molding processes, No bake molds, Flask less molds, Sweep mold, CO2 mold, Shell mold, Investment mold. Metal Molds: Gravity die casting, Pressure die casting, Centrifugal casting, Squeeze casting, Slush casting, Thixo-casting, Continuous casting.Non-metal molding, Plaster and Ceramic molding; Expandable pattern mold casting. Finishing processes: Fettling and cleaning of castings; removal of gates and risers, grinding. Non-Ferrous Foundry practice: Casting of Al-Si and Al-Mg alloys, Cu-base casting alloys.

11 Hours

UNIT – 5

Foundry Practices of Cast Irons, Steels, Inspection and Testing of Castings: Foundry practice for cast irons – gray iron, white cast iron; Ductile iron, malleable iron, SG iron, Steel castings – steel melting in the foundry; Metallurgy of cast steel; Casting design considerations;
Inspection and testing of castings: Defects in castings – types, causes and remedies; Inspection and non-destructive testing of castings. Modernization and mechanization of foundry; Material handling; Pollution control in foundry; Application of computers in casting process; Software available for casting process simulation.

10 Hours

TEXT BOOKS:

1. R.A.Flinn, “Fundamentals of Metal casting”, Addison Wesley, 1963.
2. R.W. Heine, C.R.Loper & P.C. Rosenthal, “Principles of Metal casting”, Tata McGraw Hill, 2001.

REFERENCE BOOKS

1. R.A. Lindberg, “Processes and Materials for Manufacturing”, 4th Ed, Pearson Education, 2006.
2. P.N.Rao, “Manufacturing Technology: Foundry, forming and welding”, 3rd Ed., Tata McGraw Hill, 2003.
3. “ASM Handbook: Volume 15: Casting” 9th Ed., American Society of Metals, Ohio, 2008.

COMPUTER AIDED MACHINE DRAWING

Subject Code	: 15MA36	IA Marks	:20
Hours/Week	:02L+04P, No. of Credits:04	Exam Hours	:03
Total Hours	:52	Exam Marks	:80

Common to 15ME36A / 46A

MATERIAL TESTING LABORATORY

Subject Code	: 15MAL37	IA Marks	:20
Hours/Week	:01L+02P, No. of Credits:04	Exam Hours	:03
Total Hours	:42	Exam Marks	:80

Common to 15MEL37A / 47A

FOUNDRY AND FORGING LAB

Subject Code	: 15MAL38	IA Marks	:20
Hours/Week	:01L+02P, No. of Credits:04	Exam Hours	:03
Total Hours	:42	Exam Marks	:80

Common to 15MEL38A / 48A