

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

PROPOSED B.E. SYLLABUS FOR 2018-2022

## ELEMENTS OF MECHANICAL ENGINEERING

### 18ME15/25

(Common to all Branches)

(Effective from the academic year 2018-19)

Course Code: 18ME15/25

Contact Hours/Week: 03 (2L+1T)

Total Hours: 40

Exams. Hours: 03

CIE Marks: 40

SEE Marks: 60

Credits: 03

**Course Learning Objectives:** This course (18ME15/25) will enable students to

CLO1	Learn the fundamental concepts of energy, its sources and conversion.
CLO2	Comprehend the basic concepts of thermodynamics.
CLO3	Understand the concepts of boilers, turbines, pumps, internal combustion engines and refrigeration
CLO4	Distinguish different metal joining techniques.
CLO5	Enumerate the knowledge of working with conventional machine tools, their specifications.

#### MODULES

##### MODULE-I

**Sources of Energy :** Introduction and application of energy sources like fossil fuels, hydel, solar, wind, nuclear fuels and bio-fuels; environmental issues like global warming and ozone depletion.

**Basic concepts of Thermodynamics:** Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics. Concept of internal energy, enthalpy and entropy (simple numericals).

**Steam:** Formation of steam and thermodynamic properties of steam (simple numericals).

**8 Hours**  
(RBT: L1, L2, L3)

##### MODULE-II

**Boilers:** Introduction to boilers, classification, Lancashire boiler, Babcock and Wilcox boiler. Introduction to boiler mountings and accessories (no sketches).

**Turbines:** Hydraulic Turbines – Classification and specification, Principles and operation of Pelton wheel turbine, Francis turbine and Kaplan turbine (elementary treatment only).

**Hydraulic Pumps:** Introduction, classification and specification of pumps, reciprocating pump and centrifugal pump, concept of cavitation and priming.

**8 Hours**  
(RBT: L1, L2, L3)

### MODULE – III

#### **Internal Combustion Engines**

Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines. P-V diagrams of Otto and Diesel cycles. Simple problems on indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency and specific fuel consumption.

#### **Refrigeration and Air conditioning**

Refrigeration - Definitions - Refrigerating effect, Ton of Refrigeration, Ice making capacity, COP, relative COP, Unit of Refrigeration. Refrigerants, Properties of refrigerants, List of commonly used refrigerants. Principle and working of vapor compression refrigeration and vapor absorption refrigeration. Domestic refrigerator. Principles and applications of air conditioners, window and split air conditioners.

**8 Hours**

**(RBT: L1, L2, L3)**

### MODULE IV

#### **Properties, Composition and Industrial Applications of engineering materials**

Metals – Ferrous: cast iron, tool steels and stainless steels and nonferrous: aluminum, brass, bronze. Polymers - Thermoplastics and thermosetting polymers. Ceramics - Glass, optical fiber glass, cermets. Composites - Fiber reinforced composites, Metal Matrix Composites Smart materials – Piezoelectric materials, shape memory alloys, semiconductors and insulators.

#### **Joining Processes: Soldering, Brazing and Welding**

Definitions. Classification and methods of soldering, brazing and welding. Brief description of arc welding, oxy-acetylene welding, TIG welding, and MIG welding.

#### **Belt drives**

Open & crossed belt drives, Definitions -slip, creep, velocity ratio, derivations for length of belt in open and crossed belt drive, ratio of tension in flat belt drives, advantages and disadvantages of V belts and timing belts, simple numerical problems.

#### **Gear drives**

Types–spur, helical, bevel, worm and rack and pinion. Velocity ratio, advantages and disadvantages over belt drives, simple numerical problems on velocity ratio.

**8 Hours**

**(RBT: L1, L2, L3)**

### MODULE-V

**Lathe** - Principle of working of a center lathe. Parts of a lathe. Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling, Taper turning by Tailstock offset method and Compound slide swiveling method, Specification of Lathe.

**Milling Machine** - Principle of milling, types of milling machines. Working of horizontal and vertical milling machines. Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling.

(Layout sketches of the above machines need not be dealt. Sketches need to be used only for explaining the operations performed on the machines)

#### **Introduction to Advanced Manufacturing Systems**

**Computer Numerical Control (CNC):** Introduction, components of CNC, open loop and closed loop systems, advantages of CNC, CNC Machining centers and Turning centers.

**Robots:** Robot anatomy, joints and links, common robot configurations.

Applications of Robots in material handling, processing and assembly and inspection.

**8 Hours**

**(RBT: L1, L2, L3)**

**Course Outcomes:**

Upon completion of this course, students will be able to

CO1	Identify different sources of energy and their conversion process.
CO2	Explain the working principle of hydraulic turbines, pumps, IC engines and refrigeration.
CO3	Recognize various metal joining processes and power transmission elements.
CO4	Understand the properties of common engineering materials and their applications in engineering industry.
CO5	Discuss the working of conventional machine tools, machining processes, tools and accessories.
CO6	Describe the advanced manufacturing systems.

**Question paper pattern:**

- **The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.**
- The question paper will have **ten** full questions carrying equal marks.
- Each full question consisting of **20** marks.
- There will be **two** full questions (with a **maximum** of **three** sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer **five** full questions, selecting **one** full question from each module.

**Note**

- To illustrate the concepts of operations of turbines, pumps, conventional machines like lathe, drilling, milling, grinding etc., the instructions should be blended with video presentations and visit to the laboratories/ machine shop concerned.
- Demonstration of soldering, brazing and welding should be arranged in the workshop.
- To illustrate the fundamentals of CNC machining and turning centers and robots, video presentations should be adapted in addition to class room instructions.
- The boiler mountings and accessories should be shown in the engine lab.
- Assignments should be submitted by students on materials, sources of energy, global warming, welding processes, robots and their applications. These assignments should be given due credit in awarding CIE marks.

## **TEXT BOOKS**

1. **Elements of Mechanical Engineering**, K. R. Gopalakrishna, Subhas Publications, Bangalore, 2008.
2. **Elements of Mechanical Engineering**, Vol.-1 & 2, Hajra Choudhury, Media Promoters, New Delhi, 2001.
3. **A Text Book of Elements of Mechanical Engineering**”, S. Trymbaka Murthy, 3<sup>rd</sup> revised edition 2006, I .K. International Publishing House Pvt. Ltd., New Delhi.

## **REFERENCE BOOKS**

1. **Elements of Mechanical Engineering**, R.K. Rajput, Firewall Media, 2005.
2. **Elements of Mechanical Engineering**, Dr. A. S. Ravindra, Best Publications, 7th edition, 2009.
3. **CAD/CAM/CIM**, Dr. P Radhakrishnan, 3<sup>rd</sup> edition, New Age International Publishers, New Delhi.
4. **Introduction to Robotics: Mechanics And Control**, Craig, J. J., 2<sup>nd</sup> Ed. Addison-Wesley Publishing Company, Readong, MA, 1989.
5. **Introduction to Engineering Materials**”, B.K. Agrawal ,Tata McGraHill Publication, New Delhi
6. **Thermal Science and Engineering**”, Dr. D.S. Kumar, S.K. Kataria & sons Publication, New Delhi