



B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

Course Code :	23ME1ESEME/23ME2ESEME	Course Title:	ELEMENTS OF MECHANICAL ENGINEERING
Credits:	3	L – T – P	2-0-1

Course objectives:

CLO 1: To impart the knowledge of fundamental principles of Mechanical Engineering as applied in the domains of machining, thermal, automotive and futuristic technologies.

CLO 2: To provide the knowledge on various mechanical systems and processes (energy, metal joining, IC engines etc.)

CLO 3: To explain the mathematical concepts and relationships concerning different mechanical systems.

CLO 4: To teach skills with regards to fabrication techniques and experimental analysis in various domains of Mechanical Engineering.

Teaching-Learning Process (General Instructions)

- 1.Power Point presentation,
2. Chalk and talk are used for problem solving (in-general).
3. Students are encouraged to practice only line diagrams for exams.
- 4.Video demonstration or simulations
- 5.Laboratory demonstrations and practical experiments

UNIT-1

[5 hours]

Introduction to Mechanical Engineering (Overview only):

Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors and contribution to GDP (*Not for CIE/SEE*).

Steam Formation and Application:

Formation of steam and thermodynamic properties of steam (no numerical problems), Applications of steam in industries.

Energy Sources and Power Plants:

Classification of energy sources, Construction and working of Hydel power plant, Solar power plant (Helio-thermal process, flat and parabolic collectors), Wind power plant.

UNIT-2

[5 hours]

Hydraulic turbines and pumps:

Classification of Hydraulic turbines, Principle and Operation of Pelton Wheel and Francis Turbine, Introduction to working of single stage Centrifugal Pump.

Metal Joining Processes:

Soldering, Brazing and Welding: Classification, definitions and principles of operation. Procedure followed in soldering, brazing and welding. Brief description of arc welding.

Heat Transfer Applications:

Modes of Heat Transfer: Definition, Governing laws, Principle of heat transfer in Automobile Radiators, Cooling of Electrical and Electronic Devices (Active, Passive and Hybrid Cooling.)



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UNIT-3	[5 hours]
<p>Fundamentals of IC Engines: Classification of Internal Combustion Engines, Working of 4-Stroke (petrol and diesel) engines, Applications of IC Engines, Numericals on Power and Mechanical efficiency calculations.</p> <p>Insight into future mobility technology: Introduction to Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles (block diagram only). Advantages and disadvantages of EVs and Hybrid vehicles.</p> <p>Refrigeration: Principle of refrigeration, Refrigeration effect, Ton of Refrigeration, COP, Refrigerants and their desirable properties. Principles and Operation of Vapor Compression and Vapor absorption refrigeration (with block diagrams). Applications of Refrigeration.</p>	

UNIT-4	[5 hours]
<p>Power Transmission – Belt Drives: Principle, working and application of flat and V-belt drives. Flat belt drives (Open and crossed), Simple numerical on flat belt drives involving velocity ratios (with the effect of belt thickness and slip).</p> <p>Power Transmission – Gear Drives: Classification of gear drives, Gear Trains and their application: simple and compound Gear Trains, Simple numerical on Gear trains involving velocity ratios.</p> <p>Introduction to Robotics: Robot anatomy, Joints & links, common robot configurations. Applications of Robotics.</p>	

UNIT-5	[5 hours]
<p>Fundamentals of Machine Tools and Operations: (<i>Machine tool sketches are not included for CIE/SEE</i>) Working Principle of Lathe, Milling and Drilling machine tools. Lathe Operations: Turning, Facing, Taper Turning and Knurling.</p> <p>Introduction to Modern Manufacturing Tools and Techniques: CNC: Introduction, components of CNC, advantages and applications of CNC. Additive Manufacturing: Introduction, classification, steps involved.</p> <p>Introduction to Mechatronics: Concept of open-loop and closed-loop control systems, Examples of Mechatronic systems.</p>	

LIST OF LAB PROGRAMS	
1	One model preparation using arc welding.
2	Preparation of a sheet metal model.
3	One model preparation using soldering.
4	One model preparation involving bench-drilling & tapping.
5	One lathe model involving facing, turning and knurling.
6	Performance study of Pelton wheel turbine.
7	Performance study of 4 stroke petrol engine.
8	Determination of thermal conductivity of a copper rod



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Course outcomes (Course Skills Set)

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23ME1ESEME/ 23ME2ESEME	CO1	Describe and discuss fundamental principles of Mechanical Engineering as applied in the domains of machining, thermal, automotive and futuristic technologies such as non-conventional energy technology.	1,7	3,2
	CO2	Differentiate and compare among various mechanical systems (such as energy, metal joining, IC engines etc.)	1,7	3,2
	CO3	Derive and determine parameters related to different type of mechanical systems.	1	3
	CO4	Demonstrate skills in fabrication techniques and experimental analysis related to different domains in Mechanical Engineering.	3,4	3,2

COs and POs Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3						2					
CO2	3						2					
CO3	3											
CO4	2			3								

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	Reduced Marks	Total	Min. Marks required for eligibility	Total Marks
CIE – Theory	Quiz/AAT	--	--	25	25	10	50
	Test 1	40	80				
	Test 2	40					
CIE – Lab	Record & Performance/ Lab Test	15	25		25	10	
	Experiential learning	10					
CIE							
SEE	End Exam	100		50			50
Grand Total Marks							100



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Semester End Examination: (QP PATTERN)

Answer five full questions selecting one from each module. **Two questions will be set from each module.**

Suggested Learning Resources:

Text Books

1	Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2019.
2	Elements of Mechanical Engineering, V. K. Manglik, PHI Learning, 2019

Reference Books

1	Textbook of Elements of Mechanical Engineering, S. Trymbaka Murthy, Medtech, 2019.
2	Elements of Mechanical Engineering, Kestoor Praveen, Suggi Publishing, 2019
3	Thermal Management in Electronic Equipment, HCL Technologies, 2010
4	Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education (US).

Web links and Video Lectures (e-Resources):

1	https://www.tlv.com/global/II/steam-theory/principal-applications-for-steam.html
2	https://www.forbesmarshall.com/Knowledge/SteamPedia/About-Steam/Fundamental-Applications-of-Steam
3	https://rakhoh.com/en/applications-and-advantages-of-steam-in-manufacturing-and-process-industry/
4	Videos Makino (For Machine Tool Operation)
5	Mechanisms and mechanical devices 4e.pdf (e-book- Mechanical Linkages)
