



|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)

SJB Institute of Technology

BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060

Approved by AICTE, New Delhi.

Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi

Accredited by NAAC with 'A+' grade, Certified by ISO 9001 - 2015

Recognized by UGC, New Delhi with 2(f) & 12 (B)



Semester:	I/II	Course Type:	IESC		
Course Title: Elements of Mechanical Engineering					
Course Code:	25MEI14/24		Credits:		04
Teaching Hours/Week (L:T:P:S)			3:0:2:1	Total Hours:	40+12 Lab slots
CIE Marks:	50	SEE Marks:	50	Total Marks:	100
SEE Type:	Theory			Exam Hours:	03 Hours
I. Course Objectives					
This course will enable students: <ul style="list-style-type: none">To analyse the various properties of engineering materials with their applications and different energy sourcesTo Attain the knowledge about conventional and advanced manufacturing processes.To explore the recent advances in vehicle technologies & industrial automations.To acquire the knowledge about additive manufacturing, Power Transmission system and AI concepts					
II. Teaching-Learning Process (General Instructions)					
<ul style="list-style-type: none">Adopt different types of teaching methods to develop the outcomes through Power point presentations and Video demonstrations or Simulations.Arrange visits to show the working models & processes.Adopt collaborative (Group Learning) Learning in the class.Adopt Problem Based Learning (PBL), which foster students' Analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.To conduct conventional and open ended experiments					
III. COURSE CONTENT					
III(a) Theory part					
Module-1:					8 Hours
Engineering materials: Introduction, Classification, Ferrous and Non-Ferrous metals: Types, Properties and their applications.					
Composite materials: Introduction, Constituents of a composite, Classification, Types of Matrix and Reinforcement materials, Advantages, Disadvantages and Applications of composite materials in Aerospace and Automobile industries.					
Energy Sources and Power Plants: Renewable and Non-renewable energy sources. Basic working principles of Hydel power plant, Thermal power plant, nuclear power plant, Solar power plant, and Wind power plant.					
Pre-requisites (Self Learning): Basic knowledge of engineering materials					
RBT Levels: L1, L2,L2					
Module-2:					8 Hours

Refrigeration and Air Conditioning: Introduction, Important terms used in Refrigeration, Properties of good refrigerant, Vapour compression refrigerator, Vapour absorption refrigerator. Introduction to Air conditioning and its applications. Introduction to Internal Combustion engines: Working principle of Four stroke engines (SI & CI Engines), No Numericals. Electric vehicles and Hybrid vehicles: Working principles, Electric and Hybrid vehicle components, Brief introduction to energy storage in Electric vehicles.	
Pre-requisites (Self Learning): Basic knowledge of IC engine and EV Technology	
RBT Levels: L1, L2,L3	
Module-3:	8 Hours
Machine Tools: Lathe: Working principle, Specifications, Operations performed – Turning, Facing, Taper turning by swivelling the compound rest, Thread cutting and Knurling. Drilling Machine: Working principle, Specifications, Operations performed – Drilling, Reaming, Boring, Counterboring, Countersinking, Tapping. Milling machine: Working principle, Specifications, Operations performed – Plane milling, End milling, Slot milling, Angular milling. (Sketches of machine tools not required. Sketches to be used only for explaining the operations). Joining Processes: Introduction, Temporary and Permanent joining methods: Working principle of Soldering, Brazing and Electric Arc welding, Advantages, Limitations and Applications.	
Pre-requisites (Self Learning): Basic knowledge of machine tools	
RBT Levels: L1, L2,L3	
Module-4:	8 Hours
Belt drives: Introduction, Open and Cross belt drives. (No derivations and numericals), Flat belts and V belts. Gear Drives: Types of Gears, Velocity ratio, Gear Trains - Simple and Compound gear trains and Numericals. Robotics: Introduction, Generation of Robots, Asimov's laws of Robots, Robot anatomy - Links and Joints, Types of Robots, Configurations of Robots, Robot motion - Degrees of Freedom, Robot sensors: Tactile, Force, Proximity and Vision sensors, Definition of Work volume, Accuracy, Precision, Repeatability and Payload.	
Pre-requisites (Self Learning): Basic knowledge of Power transmission	
RBT Levels: L1, L2,L3	
Module-5:	8 Hours
Computer Numerical Control (CNC): Introduction, Definition of NC and CNC Components of CNC. Definition of CAD, CAM, CAE and CIM. Automation: Definition, Types of Automation, Reasons for Automation. Additive manufacturing: Introduction, Basic principles (Steps in additive manufacturing), Additive manufacturing processes – Photopolymerization technique, Material extrusion technique and Powder based fusion technique, Automotive and Aerospace applications. Applications of AI in Mechanical Engineering: Automobile industry, manufacturing industry and Mechanical design.	
Pre-requisites (Self Learning): Basic knowledge of mechatronics & Manufacturing process	
RBT Levels: L1, L2,L3	

III(b) Practical Part

Experiments

1. Performing facing, plain turning and step turning operations by using a lathe.
2. Performing facing, plain turning and knurling operations by using a lathe.
3. Preparation of Lap Joint using the arc welding process
4. Preparation of Butt Joint using the arc welding process
5. Construct the valve timing diagram for 4 stroke engine
6. Determination of the BHN of materials using hardness testing machine.

List of open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning

1. Comparative study of flash point and fire point of various fuels / oils using the open cup method
2. Comparative study of flash point and fire point of various fuels / oils using the closed cup method
3. Comparative study on viscosity of different base fuels by Saybolt and Redwood viscometer
4. Selection and justification of appropriate joining techniques for given applications
5. Fabrication of a sheet metal part with simple geometry and soldering.

IV. COURSE OUTCOMES

CO1	Classify engineering materials (ferrous, non-ferrous, composites) and evaluate their mechanical properties using standard material testing methods.
CO2	Analyse the working principles of power plants, refrigeration systems, IC engines, electric/hybrid vehicles, and assess their role in energy efficiency and sustainability.
CO3	Demonstrate machining processes (lathe, drilling, milling) and joining techniques (welding, soldering, brazing, sheet metal work) to fabricate simple components.
CO4	Apply the concepts of power transmission, robotics, CNC, and automation
CO5	Discuss the principles of additive manufacturing and AI applications in mechanical engineering, and justify their relevance to industrial applications.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	S1	S2
CO1	3	2		2							1	1	
CO2	3	2				2					2	1	
CO3	3	1	2	2	2			2				1	
CO4	3	2										1	1
CO5	3	2	2		3	2					3	1	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure section –1

Continuous Internal Evaluation (CIE): Refer Annexure section –1

Semester End Examination (SEE): Refer Annexure section – 1

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
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1	Elements of Mechanical Engineering,	K R Gopala Krishna,	2019	Subhash Publications
2	Elements of Workshop Technology (Vol. 1 and 2)	Hazra Choudhry and Nirzar Roy	2010	Media Promoters and Publishers Pvt.
VII(b): Reference Books:				
1	An Introduction to Mechanical Engineering	Jonathan Wickert and Kemper Lewis	Third Edition	S Chand and Company
2	Manufacturing Technology- Foundry, Forming and Welding	P.N.Rao	Vol 1, 2019	Tata McGraw Hill
3	Robotics	Appu Kuttan KK	volume 1	K. International Pvt Ltd,
4	Automation, production system and CIM	Mikell P Grover	4 th edition, 2018	Pearson
5	Electric & hybrid vehicles	Iqbal Hussain	3 rd edition	Taylor & francis
VII(c): Web links and Video Lectures (e-Resources):				
<ul style="list-style-type: none"> • https://youtu.be/cT9UN1XENnk?si=EtVUDGO8cHU5xWfY • https://youtu.be/fw8Jfoif1BM?si=IbGrPZSPpcyW2BZq • https://www.youtube.com/watch?v=mNOYS-duUJYEV Electrical Systems BASICS! • https://rakhoh.com/en/applications-and-advantages-of-steam-in-manufacturing-and-process-industry/ • Videos Makino (For Machine Tool Operation) 				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
<ol style="list-style-type: none"> 1. Demonstration of lathe/milling/drilling/CNC operations 2. Demonstration of working of IC engine 3. Demonstration of metal joining process 4. Video demonstration of latest trends in mobility/robotics 5. Quiz/Assignment/Presentation 				