INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

COURSE DESCRIPTOR

Course Title	ELEMENTS OF MECHANICAL ENGINEERING				
Course Code	AME551				
Programme	B.Tech				
Semester	VI	CE			
Course Type	Open Elective				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr. G. Sarat Raju, Assistant Professor				
Course Faculty	Mr. M.Sunil Kumar, Assistant Professor				

I. COURSE OVERVIEW:

Understand about the working, functions and applications of equipment are used in daily life. Identify the broad context of Mechanical engineering problems, including describing the problem conditions and identifying possible contributing factors. Understand the fundamental elements of Mechanical engineering systems, system components and processes, with a good understanding of associated safety, quality, schedule and cost considerations. Employ mathematics, science, and computing techniques in a systematic, comprehensive, and Rigorous manner to support the study and solution of Mechanical engineering problems

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Elements of Mechanical Engineering	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & Talk	✔	Quiz	✔	Assignments	✗	MOOCs
✔	LCD / PPT	✔	Seminars	✗	Mini Project	✔	Videos
✗	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Theory**		**Total Marks**
Type of Assessment	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz / Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1	Presentation on real-world problems
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	1	Seminar
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	1	Seminar

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Engineering Knowledge:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	1	Assignment
PSO 2	**Broadness and Diversity:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	1	-
PSO 3	**Self-Learning and Service:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	1	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Familiarize with fundamental of mechanical systems.
II	Understand and appreciate the significance of mechanical engineering in different fields of engineering.
III	Understanding the application and usage of various engineering materials

IX. COURSE OUTCOMES:

CO 1	Understand the laws of thermodynamics and determine thermodynamic properties, gas laws.
CO 2	Visualize the basics of thermodynamics and components of a thermal power plant.
CO 3	Identify engineering materials, their properties, manufacturing methods encountered in engineering practice.
CO 4	Understand the concepts various metals cutting machines like lathe describe various driving mechanisms of lathe.
CO 5	Identify engineering materials, their properties, manufacturing methods encountered in engineering practice.

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
CAME551.01	CLO 1	Understand prime movers and concept of force, pressure, energy, work, power, system, heat, temperature, specific heat capacity.	PO 1	1
CAME551.02	CLO 2	Explain change of state, path, process, cycle, internal energy, enthalpy, statement of zeroth law and first law.	PO 1	1
CAME551.03	CLO 3	Understand the application, different types of energy sources.	PO 1	1
CAME551.04	CLO 4	Knowledge of Gas laws, Boyle's law, Charle's law, gas constant, relation between Cp and Cv, various non-flow processes like constant volume processes, constant pressure process, isothermal process, adiabatic process, poly-tropic process.	PO 5	1
CAME551.05	CLO 5	Demonstrate knowledge of formation of steam and use of steam table for identifying the various parameters at given conditions.	PO 5	1
CAME551.06	CLO 6	Derive the efficiency of various heat engines and problem solving.	PO 5	1
CAME551.07	CLO 7	Knowledge of different types of steam boilers and its mountings.	PO 9	1
CAME551.08	CLO 8	Explain the working principle of Internal combustion engines classification.	PO 9	1
CAME551.09	CLO 9	Demonstrate the working of pumps and air compressors.	PO 9	1
CAME551.10	CLO 10	Explain the refrigeration and air conditioning and their types.	PO 5	1
CAME551.11	CLO 11	Knowledge of various machining process of lathe, drilling and milling Machine tools	PO 1	1
CAME551.12	CLO 12	Explain the fundamentals of robotic and automation based on the coordinate systems.	PO 1	1
CAME551.13	CLO 13	Understanding the concepts about flexible automation, NC/CNC machines.	PO 1	1
CAME551.14	CLO 14	Knowledge of Engineering materials and joining processes.	PO 5	1
CAME551.15	CLO 15	Understand the applications of ferrous metals, non-ferrous metals, alloys,	PO 5	1
CAME551.16	CLO 16	Knowledge of Composites and their applications in the aircraft and automobiles.	PO 5	1

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XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)			
	PO 1	PO 5	PO 9	PSO1
CO 1	1	1		1
CO 2		1		
CO 3		1	1	

CO 4	1	1	1	1
CO 5	1	1		1

XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	1												1		
CLO 2	1												1		
CLO 3	1												1		
CLO 4					1										
CLO 5					1										
CLO 6					1										
CLO 7									1						
CLO 8									1						
CLO 9									1				1		
CLO 10					1								1		
CLO 11	1														
CLO 12	1														
CLO 13	1														
CLO 14					1								1		
CLO 15					1										
CLO 16					1										

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO 1,PO5, PO 9, PSO1	SEE Exams	PO1,PO5,PO 9, PSO1	Assignments	PO1,PO5,PO 9, PSO1	Seminars	
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO 9						

XIV. ASSESSMENT METHODOLOGIES-INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback

✗	Assessment of Mini Projects by Experts

XV. SYLLABUS

Unit-I	INTRODUCTION TO ENERGY SYSTEMS
Introduction: Prime movers and its types, concept of force, pressure, energy, work, power, system, heat, temperature, specific heat capacity, change of state, path, process, cycle, internal energy, enthalpy, statement of zeroth law and first law; Energy: Introduction and application, of energy sources like fossil fuels, nuclear fuels, hydels, solar, wind, and bio-fuels, environment issues like global warming and ozone depletion; Properties of gases: Gas laws, Boyle's law, Charle's law, gas constant, relation between Cp and Cv, various non-flow processes like constant volume processes, constant pressure process, isothermal process, adiabatic process, poly-tropic process.	
Unit-II	**STEAM TURBINES, HYDRAULIC MACHINES**
Properties of steam: Steam formation, types of steam enthalpy, specific volume, internal volume, internal energy and dryness fraction of steam, use of steam tables, calorimeters; Heat engine: Heat engine cycle and heat engine, working substances, classification of heat engines, description and thermal efficiency of Carnot, Rankin, Otto cycle, diesel cycles; Steam boilers: Introduction, Cochran, Lancashire, Babcock, and Wilcox boiler, functioning of different mountings and accessories.	
Unit-III	**INTERNAL COMBUSTION ENGINES, REFRIGERATION AND AIR-CONDITIONING**
Internal combustion engines: Introduction, classification, engine details, four stroke, two stroke cycle, petrol engine, diesel engine, indicated power, brake power, efficiencies; Pumps: Types, operation of reciprocating. rotary, centrifugal pumps, priming. Air compressors: Types, operation of reciprocating, rotary air compressors, significance of multi-staging; Refrigeration and air-conditioning: Refrigerant, vapor compression refrigeration system, vapor absorption refrigeration system, domestic refrigerator, window and split air conditioners.	
Unit-IV	**MACHINE TOOLS AND AUTOMATION**
Machine tools and automation machine tools operation: Turning, facing , knurling, thread cutting, taper turning by swiveling the compound rest, drilling, boring, reaming, tapping, counter sinking, counter boring, plane milling, end milling, slot milling; Robotic and automation: Introduction, classification based on robot configuration, polar, cylindrical, cartesian, coordinate and spherical, application, advantages and advantages; Automation: Definition, types, fixed, programmable and flexible automation, NC/CNC machines, basic elements with simple block diagrams, advantages and disadvantages.	
Unit-V	**ENGINEERING MATERIALS, JOINING PROCESS**
Engineering materials and joining processes: Types, applications of ferrous metals, non-ferrous metals, alloys; Composites: Introduction, definition, classification and application (Automobile and Air Craft).	
Text Books:	
1. V. K. Manglik, "Elements of Mechanical Engineering", Prentice Hall, 1st Edition, 2013. 2. Mikell P. Groover, "Automation, Production Systems and CIM", Prentice Hall, 4th Edition, 2015.	
Reference Books:	
1. S. Trymbaka Murthy, "A Text Book of Elements of Mechanical Engineering", University Press, 4th Edition, 2006. 2. K. P. Roy, S. K. HajraChoudary, Nirjhar Roy, "Element of Mechanical Engineering", Media Promoters & Publishers, 7th Edition, 2012. 3. Pravin Kumar, "Basic Mechanical Engineering", Pearson, 1st Edition, 2013.	

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
1-3	concept of force, pressure, energy, work, power, system, heat, temperature, specific heat capacity, change of state, path, process, cycle, internal energy, enthalpy, statement of zeroth law and first law	CLO 1	T1-1.1
4-6	Introduction and application, of energy sources like fossil fuels, nuclear fuels, hydels, solar, wind, and bio-fuels, environment issues like global warming and ozone depletion.	CLO 2	T1-1.2, R2-1.3
7-9	Gas laws, Boyle‘s law, Charle‘s law, gas constant, relation between Cv variousnon-flow processes like constant volume processes, constant pressure process, isothermal process, adiabatic process, poly-tropic process.	CLO 3	T1-1.4
10-12	Steam formation, types of steam enthalpy, specific volume, internal volume, internal energy and dryness fraction of steam, use of steam tables, calorimeters.	CLO 4	T1-2.1, R1-2.2
13-15	Heat engine cycle and heat engine, working substances, classification of heat engines, description and thermal efficiency of Carnot, Rankine, Otto cycle, diesel cycles	CLO 5	T1-2.3, R1-2.4
16-18	Introduction, Cochran, Lancashire, Babcock, and Wilcox boiler, functioning of different mountings and accessories.	CLO 6 CLO 7	T1-2.5
19-21	Introduction, classification, engine details, four stroke, two stroke cycle, petrol engine, diesel engine, indicated power, brake power, efficiencies; Pumps: Types, operation of reciprocating. rotary, centrifugal pumps, priming.	CLO 8	T1-3.1, R1-3.2
22-24	Types, operation of reciprocating, rotary air compressors, significance of multi-staging	CLO 9	T1-3.3
25-27	Refrigerant, vapor compression refrigeration system, vapor absorption refrigeration system, domestic refrigerator, window and split air conditioners.	CLO 10	T1-3.4, T2-3.4
28-30	Turning, facing, knurling, thread cutting, taper turning by swiveling the compound rest, drilling,	CLO 11	T2-4.1
31-33	boring, reaming, tapping, counter sinking, counter boring, plane milling, end milling, slot milling	CLO 12	T1-4.2, T2-4.3
34-36	Introduction, classification based on robot configuration, polar, cylindrical, Cartesian, coordinate and spherical, application, advantages; Automation: Definition, types, fixed, programmable and flexible automation, NC/CNC machines, basic elements with simple block diagrams, advantages and disadvantages	CLO 13	T1-4.4
37-39	Types, applications of ferrous metals, non-ferrous metals, alloys	CLO 14	T1-5.1
40-42	Types of joining process, types of welding	CLO 15	T1-5.2, R2-5.3
43-45	Introduction, definition, classification of Automobile	CLO 15	T1-5.2, T2-5.3
46-48	Introduction, definition, classification of Air Craft).	CLO16	T1-5.4, T2-5.5
49-51	Application of Automobile and Air Craft	CLO 16	T1-5.4, R2-5.5

XVII.GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed actions	Relevance with POS	Relevance with PSOs
1	To improve standards and analyze the concepts of materials..	Guest lectures	PO 1	PSO 1
2	Improves the practical solve problems related to Refrigeration and Air-Conditioning	Seminars / NPTEL	PO 5	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 9	PSO 1

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