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Note : Remove "Table of Content" before including in CP Book

Each Course Plan shall be printed and made into a book with cover page

Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels



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18ME15: ELEMENTS OF MECHANICAL ENGINEERING

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	ME
Year / Semester :	2019 / I	Academic Year:	2019-20
Course Title:	ELEMENTS OF MECHANICAL ENGINEERING	Course Code:	18ME15
Credit / L-T-P:	3/2-1-0	SEE Duration:	3 Hours
Total Contact Hours:	40	SEE Marks:	60 Marks
CIA Marks:	40 Marks	Assignment	1 / Module
Course Plan Author:	APPESE S D	Sign	Dt:
Checked By:		Sign	Dt:
CO Targets	CIA Target : %	SEE Target: %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Module Content	Teaching Hours	Module Concepts	Blooms Level
1	Introduction and application of energy sources Fossil fuels, hydel, solar, wind, nuclear fuels and bio-fuels Environmental issues like global warming and ozone depletion. Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics Concept of internal energy, enthalpy and entropy (simple numerical). Formation of steam and thermodynamic properties of steam Properties of steam (simple numericals).	08	Energy sources, Thermodynamic properties	L3
2	Introduction to boilers, classification, Boilers: Introduction to boilers, classification, Introduction to boiler mountings and accessories (no sketches) Hydraulic Turbines – Classification specification, Principles and operation of Pelton wheel turbine, Francis turbine and Kaplan turbine classification and specification of pumps, Reciprocating pump and centrifugal pump, Concept of cavitation and priming.	08	Steam generation, Energy conversion	L2
3	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. 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	08	Combustion, refrigeration	L2
4	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 –			



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	<p>Piezoelectric materials, shape memory alloys, semiconductors and insulators.</p> <p>Definitions. Classification and methods of soldering, brazing and welding.</p> <p>Brief description of arc welding, oxyacetylene welding, TIG welding, and MIG welding.</p> <p>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.</p> <p>Types–spur, helical, bevel, worm and rack and pinion. Velocity ratio, Advantages and disadvantages over belt drives, simple numerical problems on velocity ratio.</p>	08	Engineering materials, power transmission	L3
5	<p>Principle of working of a center lathe. Parts of a lathe. Operations on lathe -Turning, Facing, Knurling, Thread Cutting, Drilling, Taper turning by Tail stock offset method and Compound slide swiveling method, Specification of Lathe.</p> <p>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.</p> <p>Introduction, components of CNC, open loop and closed loop systems, Advantages of CNC, CNC Machining centers and Turning centers.</p> <p>Robot anatomy, joints and links, common robot configurations. Applications of Robots in material handling, processing and assembly and inspection</p>	08	Machining process, Automation	L2

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Module	Details	Available
A	Text books (Title, Authors, Edition, Publisher, Year.)	
	Elements of Mechanical Engineering, K. R. Gopalakrishna, Subhas Publications, Bangalore,2008.	In Lib, In dept
	Elements of Mechanical Engineering, Vol.-1 & 2, Hajra Choudhury, Media Promoters, New Delhi, 2001.	In Lib, In dept
	"A Text Book of Elements of Mechanical Engineering", S. Trymbaka Murthy, 3 rd revised edition 2006, I. K. International Publishing House Pvt. Ltd., New Delhi.	In Lib, In dept
B	Reference books (Title, Authors, Edition, Publisher, Year.)	
	Elements of Mechanical Engineering, R.K. Rajput, Firewall Media, 2005.	In Lib, In dept
	Elements of Mechanical Engineering, Dr. A. S. Ravindra, Best Publications, 7th edition, 2009.	In Lib, In dept
	CAD/CAM/CIM, Dr. P Radhakrishnan, 3 rd edition, New Age International Publishers, New Delhi.	In Lib, In dept
	Introduction to Robotics: Mechanics And Control, Craig, J. J., 2nd Ed. Addison-Wesley Publishing Company, Readong, MA, 1989.	In Lib, In dept
	Introduction to Engineering Materials", B.K. Agrawal, Tata McGraHill Publication, New Delhi.	In Lib, In dept
	"Thermal Science and Engineering", Dr. D.S. Kumar, S.K. Kataria & sons Publication, New Delhi	In Lib, In dept



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C	Concept Videos or Simulation for Understanding	

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

Students must have learnt the following Courses / Topics with described Content .

SNo	Course Code	Course Name	Module / Topic / Description	Sem	Remarks	Blooms Level
1	-	Physics	Force, energy wave, heat engine	PUC	Basic	L2

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Mod ules	Topic / Description	Area	Remarks	Blooms Level
1	Basic engineering physics	Higher Study	Gap A seminar on Thermodynamic	Understand L2

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Module	#	Cos	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	CO-1	students will be able to Identify different sources of energy and their conversion process.	04	Energy sources	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand
1	CO-2	students will be able to understand thermodynamic properties	04	Thermodynamic properties	Chalk & board, PPT's	Assignment CIA SEE	L3 Application
2	CO-3	students will be able to understand boiler mountings and accessories	04	Steam generation	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand
2	CO-4	students will be able to Explain the working principle of hydraulic turbines, pumps	04	Energy conversion	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand
3	CO-5	students will be able to Explain the working principle of IC engines	04	Combustion	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand



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3	CO-6	students will be able to Explain the working principle of refrigeration.	04	Refrigeration	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand
4	CO-7	students will be able to Understand the properties of common engineering materials and their applications in engineering industry.	04	Mechanical properties	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand
4	CO-8	students will be able to Recognize various power transmission elements.	04	Power transmission	Chalk & board, PPT's	Assignment CIA SEE	L3 Application
5	CO-9	students will be able to Discuss the working of conventional machine tools, machining processes, tools and accessories.	04	Machining process	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand
5	CO-10	students will be able to Describe the advanced manufacturing systems.	04	Advance manufacturing systems	Chalk & board, PPT's	Assignment CIA SEE	L2 Understand
	-	Total	40	-	-	-	-

Note: Identify a max of 2 Concepts per Module. Write 1 CO per concept.

2. Course Applications

SNo	Application Area	CO	Level
1	Power generation in Solar, wind, hydro, nuclear, thermal power plants	CO1	L2
2	Design of Heat transfer equipment's	CO2	L3
3	Thermal power plants, food processing industry, sugar plants, Textiles	CO3	L2
4	Hydro power plants	CO4	L2
5	Running of automobile vehicles	CO5	L2
6	Fridges for domestic and household purposes, air-conditioners for rooms	CO6	L2
7	Design and fabrication of various machine components	CO7	L2
8	Power transmission in vehicles, power transmission between machine components	CO8	L3
9	Used in manufacturing cylindrical jobs, flat surfaces of machine components	CO9	L2
10	Automation in industries	CO10	L2

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

#	Course Outcomes COs	Program Outcomes										Level		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
18ME25.1	students will be able to Identify different sources of energy and their conversion process.	√	-	-	-	-	-	-	-	-	-	-	-	L2
18ME25.2	students will be able to understand thermodynamic properties	√	√	-	-	-	-	-	-	-	-	-	-	L2
18ME25.3	students will be able to understand boiler mountings	√	-	-	-	-	-	-	-	-	-	-	-	L2



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	and accessories																		
18ME25.4	students will be able to Explain the working principle of hydraulic turbines, pumps	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
18ME25.5	students will be able to Explain the working principle of IC engines	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
18ME25.6	students will be able to Explain the working principle of refrigeration.	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
18ME25.7	students will be able to Understand the properties of common engineering materials and their applications in engineering industry.	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
18ME25.8	students will be able to Recognize various power transmission elements.	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
18ME25.9	students will be able to Discuss the working of conventional machine tools, machining processes, tools and accessories.	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
18ME25.10	students will be able to Describe the advanced manufacturing systems.	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
CS501PC	Average attainment (1, 2, or 3)																		
	<i>PO, PSO</i>	<i>1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design</i>																	

4. Mapping Justification

Mapping		Justification	Mapping Level
CO	PO		
CO1	1	'Engineering Knowledge.' - Acquisition of Engineering Knowledge of Energy resources is essential to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2

Mapping		Justification	Mapping Level
CO	PO		
CO2	1	Acquisition of Engineering Knowledge of thermodynamic properties is essential to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2
CO2	2	Analyzing problems require knowledge / understanding of different temperature conditions in bodies to accomplish solutions to complex engineering problems in Electronics engineering.	L2

Mapping		Justification	Mapping Level
CO	PO		
			-



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CO3	1	Acquisition of Engineering Knowledge of turbines and boilers is essential to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2
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Mapping		Justification	Mapping Level
CO	PO		-
CO4	1	Acquisition of Engineering Knowledge of hydraulic pumps is essential to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2

Mapping		Justification	Mapping Level
CO	PO		-
CO5	1	Engineering Knowledge: - Acquisition of Engineering Knowledge of engines is required to know the performance parameters to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2
CO5	2	Engineering Knowledge is require to know the knowledge of efficiency of engine	L2

Mapping		Justification	Mapping Level
CO	PO		-
CO6	1	Knowledge of refrigeration is required to understand the working principals of refrigeration and air conditioning	L2

Mapping		Justification	Mapping Level
CO	PO		-
CO7	1	Knowledge of Engineering science is required to understand the material properties	L2

Mapping		Justification	Mapping Level
CO	PO		-
CO8	1	Knowledge of basic power transmission is required	L2
CO8	2	Solving problems based on speed of the belt drives and tensions of belt drives	L2
CO8	3	Design and development of different belt drives	L2

Mapping		Justification	Mapping Level
CO	PO		-
CO9	1	Knowledge of basic engineering tools is required	L2
CO9	2	Solving problems based on cutting speed	L2
CO9	3	Development of different work pieces with different cutting operations	L2

Mapping		Justification	Mapping Level
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CO	PO		-
CO10	1	Knowledge of basic engineering tools is required	L2
CO10	2	Solving problems based on cutting speed	L2
CO10	3	Development of different work pieces with different cutting operations	L2

Note: Write justification for each CO-PO mapping.

5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	Automotive Sensors	Seminar	2 nd week	Self	

Note: Write Gap topics from A.4 and add others also.

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Module #	Title	Teaching Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Sources of Energy, Basic concepts of Thermodynamics, Steam	08	2	-	-	1	1	2	CO1, CO2	L2
2	Boilers, Turbines, Hydraulic pumps	08	2	-	-	1	1	2	CO3, CO4	L2
3	Internal Combustion Engines, Refrigeration and Air conditioning	08	-	2	-	1	1	2	CO5, CO6	L3
4	Properties, Composition and Industrial Applications of engineering materials, Joining Processes, power transmission	08	-	2	-	1	1	2	CO7, CO8	L2
5	Lathe, milling machine, CNC and robots	08	-	-	4	1	1	2	CO9, CO10	L2
-	Total	40	4	4	4	5	5	10	-	-

Note: Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

2. Continuous Internal Assessment (CIA)

Evaluation	Weight-age in Marks	CO	Levels
CIA Exam - 1	30	CO1, CO2, CO3, CO4	L2
CIA Exam - 2	30	CO5, CO6, CO7, CO8	L2
CIA Exam - 3	30	CO9, CO10	L2
Assignment - 1	10	CO1, CO2, CO3, CO4	L2
Assignment - 2	10	CO5, CO6, CO7, CO8	L2
Assignment - 3	10	CO9, CO10	L2
Seminar - 1	-	CO1, CO2, CO3, CO4	L2
Seminar - 2	-	CO5, CO6, CO7, CO8	L2
Seminar - 3	-	CO9, CO10	L2
Other Activities - define - Slip test		CO1 to CO9	L2



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Final CIA Marks	40	-	-
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Note : Blooms Level in last column shall match with A.2 above.

D1. TEACHING PLAN – 1

Module – 1

Title:	Sources of Energy, Basic concepts of Thermodynamics, Steam	Appr Time:	8 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Identify different sources of energy and their conversion process.	CO1	L1
2	understand thermodynamic properties	CO2	L2
b	<i>Course Schedule</i>	-	-
Class No	Module Content Covered	CO	Level
1	Sources of Energy : Introduction and application of energy sources like fossil fuels, hydel,	CO1	L1
2	solar, wind, nuclear fuels and bio-fuels;	CO1	L2
3	environmental issues like global warming and ozone depletion.	CO1	L2
4	Basic concepts of Thermodynamics: Introduction, states, concept of work, heat, temperature;	CO2	L2
5	Zeroth, 1st, 2nd and 3rd laws of thermodynamics.	CO2	L2
6	Concept of internal energy, enthalpy and entropy (simple numericals).	CO2	L2
7	Steam: Formation of steam and thermodynamic properties of steam	CO2	L2
8	Properties of steam (simple numericals)	CO2	L2
c	Application Areas	CO	Level
1	Power generation in Solar, wind, hydro, nuclear, thermal power plants	CO1	L3
2	Design of Heat transfer equipment's	CO2	L3
d	Review Questions	-	-
1	Briefly explain Sources of Energy	CO1	L2
2	Distinguish between Non-Renewable and Renewable energy resources.	CO1	L2
3	Define: i) Wet Steam; ii) Enthalpy of wet steam; iii) Dryness fraction.	CO2	L2
4	Explain the formation of steam at constant pressure with suitable sketches.	CO2	L2
5	Define fuel, calorific value. Describe two types of the calorific values of fuel.	CO1	L2
6	Explain global warming	CO1	L2
7	Explain ozone depletion	CO1	L2
8	Explain the terms thermodynamic states, concept of work, heat, temperature	CO2	L2
9	Define Zeroth, law of thermodynamics.	CO2	L2
10	Define 1st law of thermodynamics.	CO2	L2
11	Define 2nd law of thermodynamics.	CO2	L2
12	Define 3rd laws of thermodynamics.	CO2	L2
e	Experiences	-	-
1			

Module – 2

Title:	Boilers, Turbines and Hydraulic Pumps	Appr Time:	08 Hrs
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a	Course Outcomes	-	Blooms Level
-	The student should be able to:	-	Level
1	students will be able to understand boiler mountings and accessories		L2
2	students will be able to Explain the working principle of hydraulic turbines, pumps		L2
b	Course Schedule	-	-
Class No	Module Content Covered	CO	Level
1	Boilers: Introduction to boilers, classification,	CO3	L2
2	Lancashire boiler, Babcock and Wilcox boiler.	CO3	L2
3	Introduction to boiler mountings and accessories (no sketches).	CO3	L2
4	Turbines: Hydraulic Turbines – Classification and specification, Principles and operation of Pelton wheel turbine,	CO4	L2
5	Francis turbine and Kaplan turbine (elementary treatment only).	CO4	L2
6	Hydraulic Pumps: Introduction, classification and specification of pumps,	CO4	L2
7	Reciprocating pump and centrifugal pump,	CO4	L2
8	concept of cavitation and priming.	CO4	L2
c	Application Areas	CO	Level
1	Thermal power plants, food processing industry, sugar plants, Textiles	CO3	L3
2	Hydro power plants	CO4	L3
d	Review Questions	-	-
1	Write the detailed classification of boilers	CO3	L2
2	Briefly explain the construction & working of Lancashire Boiler	CO3	L2
3	Explain the working of Babcock and Wilcox Boiler	CO3	L2
4	Write a brief note on boiler mountings and accessories	CO3	L2
5	List the detailed classification of hydraulic turbines	CO4	L2
6	Write a note on specification of hydraulic turbines	CO4	L2
7	Explain working principle of impulse and reaction turbine.	CO4	L2
8	Explain the working principle of a Pelton Turbine.	CO4	L2
9	Explain briefly with a sketch the working of a Francis Turbine.	CO4	L2
10	Explain the working of a Kaplan Turbine.	CO4	L2
11	List the detailed classification of pumps	CO4	L2
12	Write a note on specification of pumps	CO4	L2
13	Explain the working principle of Reciprocating pump	CO4	L2
14	Explain briefly the working of centrifugal pump	CO4	L2
15	Explain the concept of cavitation and priming.	CO4	L2
e	Experiences	-	-
1			

E1. CIA EXAM – 1

a. Model Question Paper – 1

C Code:	18ME25	Sem:	II	Marks:	50	Time:	75 minutes	
Course:	ELEMENTS OF MECHANICAL ENGINEERING							
-	-	Note: Answer any 2 full questions, each carry equal marks.				CO	Level	Marks
1	a	Explain Vapour compression refrigerator with a neat sketch.				5	L2	6
	b	Explain 4-stroke petrol engine with neat sketch and pv diagram.				6	L2	7
	c	Define i)TOR ii)COP				5	L2	2
OR								



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2	a	Explain Air conditioning with a neat sketch.	5	L2	7
	b	Explain 2-stroke petrol engine with a neat sketch.	6	L2	6
	c	Four stroke IC engine running at 450 rpm has a bore dia of 100 mm and stroke length 120 mm. The indicator diagram details are area is 4cm^2 length of indicator diagram is 6.5cm and spring valve of spring used is 10 bar/cm calculate indicated power of the engine.	6	L2	2
3	a	Explain any three lathe operations with neat sketches.	9	L2	6
	b	Explain open loop and closed loop of CNC machines.	10	L2	5
	c	With a neat sketch explain cylindrical configuration robot.	10	L2	4
		OR			
4	a	Explain any three milling operations with neat sketches.	9	L2	6
	b	Explain taper turning by swiveling of compound rest method.	9	L2	5
	c	With a neat sketch explain joint armed configuration robot.	10	L2	4

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
C Code:	18ME25	Sem:	II	Marks:	10 / 10	Time:	90 – 120 minutes
Course:	ELEMENTS OF MECHANICAL ENGINEERING						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							
SNo	USN	Assignment Description			Marks	CO	Level
1	1KT18IS001	Write a note on Energy sources			10	CO1	L2
2	1KT18IS002	Differentiate between Non-Renewable and Renewable energy resources.			10	CO1	L2
3	1KT18IS003	Explain With a neat sketch Hydro-electric power plant.			10	CO1	L2
4	1KT18IS004	Explain the following terms : i) Wet Steam; ii) Enthalpy of wet steam; iii) Dryness fraction.			10	CO2	L2
5	1KT18IS005	Explain the formation of steam at constant pressure with suitable sketches.			10	CO2	L2
6	1KT18IS006	Define fuel, calorific value. Describe two types of the calorific values of fuel.			10	CO1	L2
7	1KT18IS007	Explain briefly flat plate solar collectors and solar pond with neat sketches			10	CO1	L2
8	1KT18IS008	Explain global warming			10	CO1	L2
9	1KT18IS009	Explain ozone depletion			10	CO1	L2
10	1KT18IS010	Write a note on following terms thermodynamic states, concept of work, heat, temperature			10	CO2	L2
11	1KT18IS011	State and explain Zeroth, law of thermodynamics.			10	CO2	L2
12	1KT18IS012	State and explain 1st law of thermodynamics.			10	CO2	L2
13	1KT18IS013	State and explain 2nd law of thermodynamics.			10	CO2	L2
14	1KT18IS014	State and explain 3rd laws of thermodynamics.			10	CO2	L2
15	1KT18IS015	Write the detailed classification of boilers			10	CO3	L2
16	1KT18IS016	Briefly explain the construction & working of Lancashire Boiler with a neat sketch			10	CO3	L2
17	1KT18IS017	Sketch and explain the working of Babcock and Wilcox Boiler			10	CO3	L2
18	1KT18IS018	Explain boiler mountings and accessories			10	CO3	L2
19	1KT18CV013	Write the detailed classification of hydraulic turbines			10	CO4	L2
20	1KT18CV017	Write a note on specification of hydraulic turbines			10	CO4	L2
21	1KT18CV018	Explain working principle of impulse and reaction turbine sketches.			10	CO4	L2
22	1KT18CV019	With a neat sketch explain the working principle of a Pelton Turbine.			10	CO4	L2
23	1KT18CV021	Explain briefly with a sketch the working of a Francis Turbine.			10	CO4	L2
24	1KT18CV022	With a schematic diagram explain the working of a Kaplan Turbine.			10	CO4	L2



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25	1KT18CV026	List the detailed classification of pumps	10	CO4	L2
26	1KT18CV028	Write a note on specification of pumps	10	CO4	L2
27	1KT18CV030	With a neat sketch explain the working principle of Reciprocating pump	10	CO4	L2
28	1KT18CV032	Explain briefly with a sketch the working of centrifugal pump	10	CO4	L2

D2. TEACHING PLAN - 2

Module - 3

Title:	Internal Combustion Engines, Refrigeration and Air conditioning	Appr Time:	08 Hrs
a	Course Outcomes	-	Blooms Level
-	The student should be able to:	-	Level
1	students will be able to Explain the working principle of IC engines	CO5	L2
2	students will be able to Explain the working principle of refrigeration.	CO6	L2
b	Course Schedule		
Class No	Module Content Covered	CO	Level
1	Internal Combustion Engines-Classification, I.C. Engines parts,	CO5	L2
2	2 and 4 stroke petrol and 4-stroke diesel engines.	CO5	L2
3	P-V diagrams of Otto and Diesel cycles.	CO5	L2
4	Simple problems on indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency and specific fuel consumption.	CO5	L2
5	Refrigeration - Definitions - Refrigerating effect, Ton of Refrigeration, Ice making capacity,	CO6	L2
6	COP, relative COP, Unit of Refrigeration. Refrigerants, Properties of refrigerants, List of commonly used refrigerants.	CO6	L2
7	Principle and working of vapor compression refrigeration and vapor absorption refrigeration. Domestic refrigerator.	CO6	L2
8	Principles and applications of air conditioners, window and split air conditioners.	CO6	L2
c	Application Areas	CO	Level
1	Aerospace and Automotive industries	CO5	L3
2	Fridges for domestic and household purposes, air-conditioners for rooms	CO6	L3
d	Review Questions	-	-
1	Explain Parts of Internal Combustion Engine	CO5	L2
2	Explain the working of a four stroke petrol and diesel engine.	CO5	L2
3	Explain the working of a four stroke diesel engine.	CO5	L2
4	Explain the working of a two stroke petrol engine.	CO5	L2
5	Distinguish between two stroke and four stroke I.C. Engine.	CO5	L2
6	Write the differences between petrol engine and diesel engine.	CO5	L2
7	Define the following terms-indicated power, brake power, indicated thermal efficiency.	CO5	L2
8	Define the following terms-brake thermal efficiency, mechanical efficiency and specific fuel consumption.	CO5	L2
9	Explain the parts of refrigerator.	CO6	L2
10	Define: a. Refrigeration b. Refrigeration Effect	CO6	L2
11	Explain working of vapour absorption refrigeration.	CO6	L2
12	Define: a. Ton of Refrigeration b. Ice making capacity	CO6	L2
13	Define: a. Co-efficient of performance b. Relative Co-efficient of performance	CO6	L2
14	Explain working of vapour compression refrigeration.	CO6	L2



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15	What are the properties of good refrigerant?	CO6	L2
16	List different types of refrigerants.	CO6	L2
e	Experiences	-	-
1			

Module – 4

Title:	Engineering materials,Joining Processes,Belt drives,Gear drives	Appr Time:	08 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	students will be able to Understand the properties of common engineering materials and their applications in engineering industry.	CO7	L2
2	students will be able to Recognize various power transmission elements.	CO8	L2
b	Course Schedule		
Class No	Module Content Covered	CO	Level
1	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.	CO7	L2
2	Composites - Fiber reinforced composites, Metal Matrix Composites Smart materials – Piezoelectric materials, shape memory alloys, semiconductors and insulators.	CO7	L2
3	Definitions. Classification and methods of soldering, brazing and welding.	CO7	L2
4	Brief description of arc welding, oxy-acetylene welding, TIG welding, and MIG welding.	CO7	L2
5	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,	CO8	L2
6	advantages and disadvantages of V belts and timing belts, simple numerical problems.	CO8	L2
7	Types–spur, helical, bevel, worm and rack and pinion. Velocity ratio, advantages and disadvantages over belt drives,	CO8	L2
8	simple numerical problems on velocity ratio.	CO8	L2
c	Application Areas	CO	Level
1	Design and fabrication of various machine components in Aerospace and Automotive industries?	CO7	L2
2	Power transmission in vehicles, power transmission between machine components	CO8	L2
d	Review Questions	-	-
1	Define a composite material. How are composite materials classified? Give example for each.	CO7	L2
2	Write the applications of Composite Materials.	CO7	L2
3	What are the key applications of composite materials in Aerospace and Automotive industries?	CO7	L2
4	State the composition and application of any four ferrous metals.	CO7	L2
5	Briefly explain the types and applications of Non-ferrous alloys.	CO7	L2
6	State the composition, properties and applications of high carbon steels.	CO7	L2
7	Write a note on Ferrous Alloys.	CO7	L2
8	Write a note on Non-Ferrous Alloys	CO7	L2
9	Define the following terms -slip, creep, velocity ratio, ratio of tension in flat belt drives	CO8	L2
10	Derive the relation for length of belt in open and crossed belt drive,	CO8	L2
11	Write the advantages and disadvantages of V belts and timing belts	CO8	L2



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12	Write the advantages and disadvantages of gear drives over belt drives	CO8	L2
e	Experiences	-	-
1		CO7	L2

E2. CIA EXAM – 2

a. Model Question Paper - 2

C Code: 18ME25	Sem: II	Marks: 30	Time: 75 minutes
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Course: ELEMENTS OF MECHANICAL ENGINEERING

-	-	Note: Answer any 2 questions, each carry equal marks.	Marks	CO	Level
1	a	Explain with a neat sketch Parts of Internal Combustion Engine	20	CO5	L2
	b	Explain the parts of refrigerator.		CO6	L2
	c	Define a composite material. How are composite materials classified? Give example for each.		CO7	L2
	d	Briefly describe arc welding.		CO8	L2
2	a	With the help of PV diagram explain the working of a four stroke petrol and diesel engine.	20	CO5	L2
	b	Define: a. Refrigeration b. Refrigeration Effect		CO6	L2
	c	Write the applications of Composite Materials.		CO7	L2
	d	Describe oxy-acetylene welding with a neat sketch.		CO8	L2
3	a	With the help of PV diagram explain the working of a four stroke diesel engine.	20	CO5	L2
	b	Explain with neat sketch vapour absorption refrigeration.		CO6	L2
	c	State the composition, properties and applications of high carbon steels.		CO7	L2
	d	Derive the relation for length of belt in open and crossed belt drive.		CO8	L2
4	a	With a neat sketch explain the working of a two stroke petrol engine.	20	CO5	L2
	b	Define: a. Ton of Refrigeration b. Ice making capacity		CO6	L2
	c	Write a note on Ferrous Alloys.		CO7	L2
	d	Write the advantages and disadvantages of V belts and timing belts		CO8	L2

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code: 18ME25	Sem: II	Marks: 10/ 10	Time: 90 – 120 minutes				
Course: ELEMENTS OF MECHANICAL ENGINEERING							

Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.

SNo	USN	Assignment Description	Marks	CO	Level
1	1KT18IS001	Explain with a neat sketch Parts of Internal Combustion Engine	10	CO5	L2
2	1KT18IS002	Explain the working of a four stroke petrol engine with the help of PV diagram.	10	CO5	L2



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3	1KT18IS003	With the help of PV diagram explain the working of a four stroke diesel engine.	10	CO5	L2
4	1KT18IS004	With a neat sketch explain the working of a two stroke petrol engine.	10	CO5	L2
5	1KT18IS005	Distinguish between two stroke and four stroke I.C. Engine.	10	CO5	L2
6	1KT18IS006	Write the differences between petrol engine and diesel engine.	10	CO5	L2
7	1KT18IS007	Define the following terms-indicated power, brake power, indicated thermal efficiency.	10	CO5	L2
8	1KT18IS008	Define the following terms-brake thermal efficiency, mechanical efficiency and specific fuel consumption.	10	CO5	L2
9	1KT18IS009	Explain the parts of refrigerator.	10	CO6	L2
10	1KT18IS010	Define: a. Refrigeration b. Refrigeration Effect	10	CO6	L2
11	1KT18IS011	Explain with neat sketch vapour absorption refrigeration.	10	CO6	L2
12	1KT18IS012	Define: a. Ton of Refrigeration b. Ice making capacity	10	CO6	L2
13	1KT18IS013	Define: a. Co-efficient of performance b. Relative Co-efficient of performance	10	CO6	L2
14	1KT18IS014	Explain with neat sketch vapour compression refrigeration.	10	CO6	L2
15	1KT18IS015	What are the properties of good refrigerant?	10	CO6	L2
16	1KT18IS016	List different types of refrigerants.	10	CO6	L2
17	1KT18IS017	Define a composite material. How are composite materials classified? Give example for each.	10	CO7	L2
18	1KT18IS018	Write the applications of Composite Materials.	10	CO7	L2
19	1KT18CV013	What are the key applications of composite materials in Aerospace and Automotive industries?	10	CO7	L2
20	1KT18CV017	State the composition and application of any four ferrous metals.	10	CO7	L2
21	1KT18CV018	Briefly explain the types and applications of Non-ferrous alloys.	10	CO7	L2
22	1KT18CV019	State the composition, properties and applications of high carbon steels.	10	CO7	L2
23	1KT18CV021	Write a note on Ferrous Alloys.	10	CO7	L2
24	1KT18CV022	Write a note on Non-Ferrous Alloys	10	CO7	L2
25	1KT18CV026	Briefly describe arc welding,	10	CO8	L2
26	1KT18CV028	Describe oxyacetylene welding with a neat sketch,	10	CO8	L2
27	1KT18CV030	Explain with sketch TIG welding,	10	CO8	L2
28	1KT18CV032	Briefly describe MIG welding.	10	CO8	L2
29	1KT18IS001	Define the following terms -slip, creep, velocity ratio, ratio of tension in flat belt drives	10	CO8	L2
30	1KT18IS002	Derive the relation for length of belt in open and crossed belt drive,	10	CO8	L2
31	1KT18IS003	Write the advantages and disadvantages of V belts and timing belts	10	CO8	L2
32	1KT18IS004	Write the advantages and disadvantages of gear drives over belt drives	10	CO8	L2



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D3. TEACHING PLAN - 3

Module – 5

Title:	Lathe, Milling machine, CNC and Robots	Appr Time:	08 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	students will be able to Discuss the working of conventional machine tools, machining processes, tools and accessories.	CO9	L2
2	students will be able to Describe the advanced manufacturing systems.	CO10	L2
b	Course Schedule		
Class No	Module Content Covered	CO	Level
1	Lathe - Principle of working of a center lathe. Parts of a lathe. Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling.	CO9	L2
2	Taper turning by Tailstock offset method and Compound slide swiveling method, Specification of Lathe.	CO9	L2
3	Milling Machine - Principle of milling, types of milling machines. Working of horizontal and vertical milling machines.	CO9	L2
4	Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling.	CO9	L2
5	Computer Numerical Control (CNC): Introduction, components of CNC,	CO10	L2
6	open loop and closed loop systems, advantages of CNC, CNC Machining centers and Turning centers.	CO10	L2
7	Robots: Robot anatomy, joints and links, common robot configurations.	CO10	L2
8	Applications of Robots in material handling, processing and assembly and inspection	CO10	L2
c	Application Areas	CO	Level
1	Used in manufacturing cylindrical jobs, flat surfaces of machine components	CO9	L2
2	Automation in industries	CO10	L2
d	Review Questions	-	-
1	Write the Specification of Lathe.	CO9	L2
2	Explain the Principle of working of a center lathe.	CO9	L2
3	Explain the following Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling,	CO9	L2
4	Explain with a sketch Taper turning by Tail-stock offset method	CO9	L2
5	Explain with a sketch Taper turning by Compound slide swiveling method,	CO9	L2
6	Illustrate with sketch Principle of milling,	CO9	L2
7	Explain with sketches the following Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling.	CO9	L2
8	Sketch and explain the Working of horizontal milling machine.	CO9	L2
9	Sketch and explain the Working of vertical milling machine.	CO9	L2
10	Define Automation? Explain briefly different types of Automation	CO10	L2
11	Explain briefly NC and CNC Machines with the help of flow diagram.	CO10	L2
12	Define Robot? Explain with a neat sketch different configuration system of robots.	CO10	L2
13	Write the Advantages and Disadvantages of NC and CNC Machines.	CO10	L2
14	Categorize the applications of Robots in material handling, processing and	CO10	L2



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	assembly and inspection.		
e	Experiences	-	-
1			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	18ME25	Sem:	II	Marks:	30	Time:	75 minutes	
Course:	ELEMENTS OF MECHANICAL ENGINEERING							
-	-	Note: Answer any 2 questions, each carry equal marks.				Marks	CO	Level
1	a	Explain the following Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling.				20	CO9	L2
	b	Define Automation? Explain briefly different types of Automation					CO10	L2
2	a	Explain with sketches the following Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling.				20	CO9	L2
	b	Explain briefly NC and CNC Machines with the help of flow diagram.					CO10	L2
3	a	Explain with a sketch Taper turning by Compound slide swiveling method,				20	CO9	L2
	b	Define Robot? Explain with a neat sketch different configuration system of robots.					CO10	L2
4	a	Sketch and explain the Working of vertical milling machine.				20	CO9	L2
	b	Categorize the applications of Robots in material handling, processing and assembly and inspection.					CO10	L2

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions								
Crs Code:	18ME25	Sem:	II	Marks:	10 / 10	Time:	90 – 120 minutes	
Course:	ELEMENTS OF MECHANICAL ENGINEERING							
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.								
SNo	USN	Assignment Description				Marks	CO	Level
1	1KT18IS001	Write the Specification of Lathe.				10	CO9	L2
2	1KT18IS002	Explain the Principle of working of a center lathe.				10	CO9	L2
3	1KT18IS003	Explain the following Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling.				10	CO9	L2
4	1KT18IS004	Explain with a sketch Taper turning by Tail-stock offset method				10	CO9	L2
5	1KT18IS005	Explain with a sketch Taper turning by Compound slide swiveling method,				10	CO9	L2
6	1KT18IS006	Illustrate with sketch Principle of milling.				10	CO9	L2
7	1KT18IS007	Explain with sketches the following Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling.				10	CO9	L2
8	1KT18IS008	Sketch and explain the Working of horizontal milling machine.				10	CO9	L2
9	1KT18IS009	Sketch and explain the Working of vertical milling machine.				10	CO9	L2
10	1KT18IS010	Define Automation? Explain briefly different types of Automation				10	CO10	L2
11	1KT18IS011	Explain briefly NC and CNC Machines with the help of flow diagram.				10	CO10	L2
12	1KT18IS012	Define Robot? Explain with a neat sketch different configuration system of robots.				10	CO10	L2
13	1KT18IS013	Write the Advantages and Disadvantages of NC and CNC				10	CO10	L2



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		Machines.			
14	1KT18IS014	Categorize the applications of Robots in material handling, processing and assembly and inspection.	10	CO10	L2
15	1KT18IS015	Write the Specification of Lathe.	10	CO9	L2
16	1KT18IS016	Explain the Principle of working of a center lathe.	10	CO9	L2
17	1KT18IS017	Explain the following Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling,	10	CO9	L2
18	1KT18IS018	Explain with a sketch Taper turning by Tail-stock offset method	10	CO9	L2
19	1KT18CV013	Explain with a sketch Taper turning by Compound slide swiveling method,	10	CO9	L2
20	1KT18CV017	Illustrate with sketch Principle of milling,	10	CO9	L2
21	1KT18CV018	Explain with sketches the following Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling.	10	CO9	L2
22	1KT18CV019	Sketch and explain the Working of horizontal milling machine.	10	CO9	L2
23	1KT18CV021	Sketch and explain the Working of vertical milling machine.	10	CO9	L2
24	1KT18CV022	Define Automation? Explain briefly different types of Automation	10	CO10	L2
25	1KT18CV026	Explain briefly NC and CNC Machines with the help of flow diagram.	10	CO10	L2
26	1KT18CV028	Define Robot? Explain with a neat sketch different configuration system of robots.	10	CO10	L2
27	1KT18CV030	Write the Advantages and Disadvantages of NC and CNC Machines.	10	CO10	L2
28	1KT18CV032	Categorize the applications of Robots in material handling, processing and assembly and inspection.	10	CO10	L2

F. EXAM PREPARATION

1. University Model Question Paper

Course:	ELEMENTS OF MECHANICAL ENGINEERING				Month / Year	May /2018		
Crs Code:	18ME25	Sem:	II	Marks:	100	Time:	180 minutes	
-	Note	Answer all FIVE full questions. All questions carry equal marks.				Marks	CO	Level
1	a	Distinguish between Non-Renewable and Renewable energy resources.				20	CO1	L2
	b	Define: i) Wet Steam; ii) Enthalpy of wet steam; iii) Dryness fraction.					CO2	L2
	c	Explain global warming					CO1	L2
	d	Write a note on following terms thermodynamic states, concept of work, heat, temperature					CO2	L2
		OR						
-	a	With a neat sketch briefly explain the Hydro-electric power plant.				20	CO1	L2
	b	Explain the formation of steam at constant pressure with suitable sketches.					CO2	L2
	c	Explain ozone depletion					CO1	L2
	d	Define laws of thermodynamics.					CO2	L2



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2	a	Write a brief note on boiler mountings and accessories	20	CO3	L2
	b	Explain briefly with a sketch the working of centrifugal pump		CO4	L2
	c	With a neat sketch explain the working of Babcock and Wilcox Boiler		CO3	L2
	d	With a neat sketch explain the working principle of Reciprocating pump		CO4	L2
		OR			
-	a	Write the detailed classification of boilers	20	CO3	L2
	b	With a neat sketch explain the working principle of a Pelton Turbine.		CO4	L2
	c	Briefly explain the construction & working of Lancashire Boiler with a neat sketch		CO3	L2
	d	Explain briefly with a sketch the working of a Francis Turbine.		CO4	L2
3	a	Explain with a neat sketch Parts of Internal Combustion Engine	20	CO5	L2
	b	Explain the parts of refrigerator.		CO6	L2
	c	With the help of PV diagram explain the working of a four stroke diesel engine.		CO5	L2
	d	Explain with neat sketch vapour absorption refrigeration.		CO6	L2
		OR			
-	a	With the help of PV diagram explain the working of a four stroke petrol and diesel engine.	20	CO5	L2
	b	Define: a. Refrigeration b. Refrigeration Effect		CO6	L2
	c	With a neat sketch explain the working of a two stroke petrol engine.		CO5	L2
	d	Define: a. Ton of Refrigeration b. Ice making capacity		CO6	L2
4	a	Write a note on Ferrous Alloys.	20	CO7	L2
	b	Write the advantages and disadvantages of V belts and timing belts		CO8	L2
	c	State the composition, properties and applications of high carbon steels.		CO7	L2
	d	Derive the relation for length of belt in open and crossed belt drive,		CO8	L2
-	a	Define a composite material. How are composite materials classified? Give example for each.	20	CO7	L2
	b	Briefly describe arc welding,		CO8	L2
	c	Write the applications of Composite Materials.		CO7	L2
	d	Describe oxy-acetylene welding with a neat sketch,		CO8	L2
5	a	Explain the following Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling,	20	CO9	L2
	b	Define Automation? Explain briefly different types of Automation		CO10	L2
		OR			
	a	Explain with sketches the following Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling.	20	CO9	L2
	b	Explain briefly NC and CNC Machines with the help of flow diagram.		CO10	L2

2. SEE Important Questions

Course:	ELEMENTS OF MECHANICAL ENGINEERING				Month / Year	May /2018	
Crs Code:	18ME25	Sem:	II	Marks:	100	Time:	180 minutes
Note	Answer all FIVE full questions. All questions carry equal marks.					-	-
Module	Qno.	Important Question			Marks	CO	Year
1	1	Explain global warming			20	CO1	2014
	2	Explain ozone depletion				CO1	2016
	3	Write a note on following terms thermodynamic states, concept of work, heat, temperature				CO2	2004



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	4	Define Zeroth law of thermodynamics.		CO2	2007
	5	Define 1st law of thermodynamics.		CO2	2007
2	1	With a neat sketch explain the working of Babcock and Wilcox Boiler	20	CO3	2005
	2	Write a brief note on boiler mountings and accessories		CO3	2015
	3	With a neat sketch explain the working principle of a Pelton Turbine.		CO4	2009
	4	With a neat sketch explain the working principle of Reciprocating pump		CO4	2016
	5	Explain the concept of cavitation and priming.		CO4	2008
3	1	Explain with a neat sketch Parts of Internal Combustion Engine	20	CO5	2012
	2	With the help of PV diagram explain the working of a four stroke petrol and diesel engine.		CO5	2010
	3	Write the differences between petrol engine and diesel engine.		CO5	2007
	4	Explain with neat sketch vapour compression refrigeration.		CO6	2004
	5	Explain with neat sketch vapour absorption refrigeration.		CO6	2011
4	1	State the composition, properties and applications of high carbon steels.	20	CO7	2004
	2	Describe oxy-acetylene welding with a neat sketch,		CO7	2004
	3	Define the following terms -slip, creep, velocity ratio, ratio of tension in flat belt drives		CO8	2006
	4	Derive the relation for length of belt in open belt drive,		CO8	2004
	5	Write the advantages and disadvantages of gear drives over belt drives		CO8	2007
5	1	Explain with a sketch Taper turning by Compound slide swiveling method,	20	CO9	2009
	2	Sketch and explain the Working of vertical milling machine.		CO9	2007
	3	Define Automation? Explain briefly different types of Automation		CO10	2016
	4	Explain briefly NC and CNC Machines with the help of flow diagram.		CO10	2015
	5	Define Robot? Explain with a neat sketch different configuration system of robots.		CO10	2017

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Module- #	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning
1	Introduction and application of energy sources Fossil fuels, hydel, solar, wind, nuclear fuels and bio-fuels Environmental issues like global warming and ozone depletion. Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics Concept of internal energy, enthalpy and entropy (simple numerical). Formation of steam and thermodynamic properties of steam Properties of steam (simple numericals).	08	Energy sources, Thermodynamic properties	Chalk & Talk + PPT & Video	Writing	L2 Understand
2	Introduction to boilers, classification, Boilers: Introduction to boilers, classification, Introduction to boiler mountings and accessories (no sketches) Hydraulic Turbines – Classification specification, Principles and operation of Pelton wheel turbine, Francis turbine and Kaplan turbine. Classification and specification of pumps, Reciprocating pump and centrifugal pump, Concept of cavitation and priming.	08	Steam generation, Energy conversion	Chalk & Talk + PPT & Video	Writing	L2 Understand
3	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. 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	08	Combustion, refrigeration	Chalk & Talk + PPT & Video	Writing	L2 Understand
4	Metals – Ferrous: cast iron, tool steels and stainless steels and nonferrous: aluminum, brass, bronze. Polymers – Thermoplastics and thermo setting polymers. Ceramics -Glass, optical fiber glass, cermet's. Composites – Fiber reinforced composites, Metal Matrix Composites Smart materials – Piezoelectric materials, shape memory alloys, semiconductors and insulators. Definitions. Classification and methods of soldering, brazing and welding. Brief description of arc welding, oxyacetylene welding, TIG welding, and MIG welding. 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. Types–spur, helical, bevel, worm and rack and pinion. Velocity ratio, Advantages and	08	Engineering materials, power transmission	Chalk & Talk + PPT & Video	Writing	L2 Understand

	disadvantages over belt drives, simple numerical problems on velocity ratio.					
5	<p>Principle of working of a center lathe. Parts of a lathe. Operations on lathe -Turning, Facing, Knurling, Thread Cutting, Drilling, Taper turning by Tail stock offset method and Compound slide swiveling method, Specification of Lathe.</p> <p>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.</p> <p>Introduction, components of CNC, open loop and closed loop systems, Advantages of CNC, CNC Machining centers and Turning centers.</p> <p>Robot anatomy, joints and links, common robot configurations. Applications of Robots in material handling, processing and assembly and inspection.</p>	8	Machining process, Automation	Chalk & Talk + PPT & Video	Writing	L2 Understand

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example

Module-#	Course Content (Split into 2 parts for each Module)	Teach. Hour	Refined Concept	Course Outcome Components			Blooms' Level
				Action Condition/methodology,	Verb,	Knowledge, Bench mark	
1	Introduction and application of energy sources Fossil fuels, hydel, solar, wind, nuclear fuels and bio-fuels Environmental issues like global warming and ozone depletion.	04	Sources of energy	The sources of Energy like renewable and nonrenewable.			L2 Understand
1	Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics Concept of internal energy, enthalpy and entropy (simple numerical). Formation of steam and thermodynamic properties of steam Properties of steam (simple numericals).	04	Properties of thermodynamics	Laws of thermodynamic and formation of steam.			L2 Understand
2	Introduction to boilers, classification, Boilers: Introduction to boilers, classification, Introduction to boiler mountings and accessories (no sketches) Hydraulic Turbines - Classification specification, Principles and operation of Pelton wheel turbine, Francis turbine and Kaplan turbine.	04	Steam generation,	Working and construction of boiler for formation of steam.			L2 Understand
2	Classification and specification of pumps, Reciprocating pump and centrifugal pump, Concept of cavitation and priming.	04	Energy conversion	Working of centrifugal and reciprocating pumps.			L2 Understand
3	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.	04	Combustion	Classification of I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines working.			L2 Understand
3	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	04	Refrigeration and Air conditioning	working of vapor compression refrigeration and vapor absorption refrigeration.			L2 Understand
4	Metals – Ferrous: cast iron, tool steels and stainless steels and nonferrous: aluminum, brass, bronze. Polymers –	04	Engineering material	Properties of different materials and joining process of welding and types of joining process.			L2 Understand

	<p>Thermoplastics and thermo setting polymers. Ceramics -Glass, optical fiber glass, cermet's. Composites - Fiber reinforced composites, Metal Matrix Composites Smart materials - Piezoelectric materials, shape memory alloys, semiconductors and insulators.</p> <p>Definitions. Classification and methods of soldering, brazing and welding. Brief description of arc welding, oxyacetylene welding, TIG welding, and MIG welding.</p>		s and Joining processes		
4	<p>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.</p> <p>Types-spur, helical, bevel, worm and rack and pinion. Velocity ratio, Advantages and disadvantages over belt drives, simple numerical problems on velocity ratio.</p>	04	power transmission	<p>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</p>	L2 Understood
5	<p>Principle of working of a center lathe. Parts of a lathe. Operations on lathe -Turning, Facing, Knurling, Thread Cutting, Drilling, Taper turning by Tail stock offset method and Compound slide swiveling method, Specification of Lathe.</p> <p>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.</p>	04	Machining operations	<p>Machining processes like Turning, Facing, Knurling, Thread Cutting, Drilling, Taper turning by Tail stock offset method</p>	L2 Understood
5	<p>Introduction, components of CNC, open loop and closed loop systems, Advantages of CNC, CNC Machining centers and Turning centers.</p> <p>Robot anatomy, joints and links, common robot configurations. Applications of Robots in material handling, processing and assembly and inspection.</p>	04	Automation	<p>Components of CNC, open loop and closed loop systems. Applications of Robots in material handling, processing and assembly and inspection.</p>	L2 Understood