Dayananda Sagar College of Engineering

(Autonomous Institute, Affiliated to Visvesvaraya Technical Universit

Bangalore-560078

SEMESTER - I/II

Subject name: **ELEMENTS OF MECHANICAL ENGINEERING**		**CREDITS – 03**	
Subject Code	**EME14/EME24**	CIE MARKS	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	39	Exam Hours	03

Module 1: Steam and Turbines

S.N	QUESTION	MARKS	LEVEL	Co.'s
1	Explain with the help of a P-V diagram the formation of steam at Constant Pressure.	10	4	1
2	Classify the different states of Steam and explain each one of them.	10	4	1
3	Define Enthalpy of Steam. Distinguish between the enthalpy of steam in its different states.	10	5	1
4	Explain the terms - Specific Volume, external work of evaporation, internal latent heat and Internal energy of steam with the help of suitable equations.		4	1
5	What do you conclude after listing the advantages and disadvantages of Superheated Steam? Compare Superheated Steam with Dry Saturated Steam.	4	3	1
6	Construct a temperature-enthalpy diagram for a constant pressure heating process to represent on it the following i) Sensible heat region ii) Latent heat region iii) Superheated region iv) Dryness fraction of 0.75	4	3	1
7	While adapting the different states of steam available, elaborate on these with suitable examples.	10	2	1
8	Find the enthalpy of 1Kg of steam at 12 bar when a) Steam is dry saturated b) Steam is 22% wet and c) Superheated to 250^0c. Use the steam table. Assume the specific heat of steam as 2.25KJ/KgK.	10	4	1
9	Two Kg of dry saturated steam at 1Mpa is produced from the water at 40^0c. Determine the quantity of heat supplied. The specific heat of water is C_{pw} = 4.18KJ/kg. Determine the total heat content per unit mass (specific enthalpy) to water when it exists in the following state using Steam tables. Assume ambient Pressure to be 100KPa i) 10 bar absolute and 300^0c ii) 100 Kpa gauge and 150^0c iii) Steam at 12 bar & 95% quality iv) Saturated Water at 10^0c v) Dry saturated steam at 100kpa absolute	10 10	4 3	1
10	Explain the working principle of Pelton wheel by sketching and	08	2	1

	labeling all its parts.			
11	With a neat sketch explain the construction and working of a single stage impulse steam turbine.	06	2	1
12	Sketch and briefly explain the working of a reaction steam turbine with the help of pressure and velocity profile diagrams.	06	2	1
13	Draw a schematic front view of a Francis turbine and label its parts. Explain the functions of all its parts.	08	2	1
14	Bring out the differences between impulse and reaction steam turbines.	06	2	1
15	Sketch and explain the working of Kaplan turbine. Explain its advantages and disadvantages?	06	2	1
16	Explain with block diagrams the principle of operation of closed and open cycle gas turbines.	10	2	1
17	Sketch and briefly explain the working of Delaval's turbine.	06	2	1
18	Sketch and briefly explain the working of Parson's turbine.	06	2	1
19	Compare closed cycle and open cycle gas turbine.	06	4	1

Question no.	Questions **MODULE-2** **IC ENGINES**	Marks	Blooms level	CO's
1	A two stroke internal combustion engine has a stroke length of 150mm and cylinder diameter 100mm. Its mean effective pressure is 5.4 x 10^5m/m^2 and crankshaft speed is 1000, find the indicated power.	10	2	1
2	The following observations were obtained during a trial on a four-stroke diesel engine Cylinder diameter = 25cm Stroke of the Piston = 40cm Crankshaft Speed = 250rpm Brake load = 70Kg Brake drum diameter = 2m Mean effective pressure = 6 Bar Diesel Oil Consumption = 0.1m^3/min Specific Gravity of diesel = 0.78 Calorific value of diesel = 43900KJ/Kg **Find:** 1) Brake Power 2) Indicated Power 3) Frictional Power 4) Mechanical Efficiency 5) Brake Thermal Efficiency 6) Indicated Thermal Efficiency	10	2	1
3	What are heat engines? What are the different types of heat engines?	04	1	1
4	What are internal and external combustion engines? Give examples	04	1	1
5	Define the following: (a) Brake power and (b) Indicated power, (c) Compression ratio and (d) mean effective pressure of an IC engine.	02*4	1	1
6	Draw a neat sketch of an IC engine and describe all the parts.	10	2	1
	With the help of schematic diagram explain the working of a 4-stroke cycle petrol engine. Show all the processes in a cycle on a PV diagram.	10	2	1

7	With the help of a p-v diagram, describe the working of four stroke diesel engine.	10	2	1
8	Explain with a neat sketch working of a 2-stroke petrol engine.	10	2	1
9	A 4 stroke diesel engine has a piston diameter 250 mm and stroke 400 mm. The mean effective pressure is 4 Bar and speed is 500 rpm. The diameter of the brake drum is 1000 mm and the effective brake load is 400 N. Solve to determine indicated power, brake power and frictional power.	10	3	1
10	A single cylinder 4-stroke engine runs at 1000 rpm and has a bore of 115 mm and a stroke of 140 mm. The brake load is 60N at 600 mm radius and the mechanical efficiency is 80%. Solve the problem by calculating brake power and mean effective pressure.	10	3	1
11	In an experiment, a 4- stroke I.C engine running at 450 rpm has bore diameter 100 mm and stroke length 120 mm. The details of the indicator diagram are as follows. Area of indicator diagram = 4 cm^2 Length of the indicator diagram = 6.5 cm and The spring value of the spring used is 10 Bar/cm. Calculate the indicated power of the engine from this experimental data.	10	3	1
12	A 4-cylinder 2-S petrol engine develops 26 KW brake power at 2200 rpm. The mean effective pressure is 7bar and mechanical efficiency is 87%. Solve to determine the bore diameter and stroke of the engine if stroke length is 1.5 times the bore.	10	3	1
13	Solve the problem for a 4-S I.C engine with a piston diameter of 150 mm and the average piston speed is 3.5 m/sec. If the M.E.P is 0.786 MPa, find the IP of the engine.	10	3	1
14	Compare SI engine and CI engine. Give an example in each case.	06	4	1
15	Compare a two-stroke engine with a four stroke engine.	06	4	1
16	Examine the given information by evaluating brake power output of a single cylinder 4-S petrol engine: Diameter of Brake wheel = 600mm Brake rope diameter = 30mm Dead weight = 24kg Spring balance reading = 4 kg , RPM = 450	10	4	1
17	The following details are the test result of a single cylinder, 4-S I.C engine IP = 26 KW; BP = 22KW Engine speed = 400 rpm; Fuel/BP hour = 0.33 kg Calorific value of fuel = 44300kJ/kg Predict the following parameters with proper	10	5	1

	justification: (a) Mechanical efficiency, (b) Indicated thermal efficiency (c) Brake thermal efficiency			
18	The following observations were recorded during a test on a 4-S engine Bore = 25 cm Stroke = 40 cm Crankspeed = 250 rpm Net load on brake drum = 700N Diameter of Brake drum = 2 m Indicated M.E.P = 6 bar Fuel consumption = 0.0013kg/s Sp. Gravity of fuel = 0.78 C.V of fuel = 43900 KJ/ Kg Estimate the following parameters with justification: (a) BP (d) Mechanical Efficiency (b) IP (e) Indicated thermal efficiency (c) FP (f) Brake thermal efficiency	12	5	1
19	A diesel engine has brake thermal efficiency of 28%. If the Calorific value of fuel is 42500 KJ/Kg, estimate its brake specific fuel consumption.	10	5	1
20	A diesel engine develops 5KW. Its indicated thermal efficiency is 30% and mechanical efficiency 57%. Estimate the fuel consumption of engine in, a) Kg/hr b) Liters/hr Also find c) ISFC d) BSFC	12	5	1
21	A single cylinder 4-S I.C engine has a swept volume of 6 liters and runs at a rated speed of 300 rpm. At full load, the torque developed was measured with a belt dynamometer whose pulley diameter is 1m. The tension in the tight side and slack side of the belt is 700N and 300N respectively. 4 Kg of fuel was consumed in one hour. The indicated mean effective pressure is 6 bar and the C.V of the fuel is 42000kJ/Kg. Estimate the brake power, indicated power, mechanical efficiency, indicated thermal efficiency, brake thermal efficiency and brake specific fuel consumption.	12	5	1
22	The following observations were made during a trail on a single cylinder 4-S cycle oil engine Stroke = 300 mm; Bore = 200 mm Piston speed = 3.5 m/s; Torque = 630 N-m Mechanical efficiency = 85%; Indicated thermal efficiency = 30% Calorific value of fuel = 43900 KJ/Kg How would you evaluate the mean effective pressure and mass of fuel consumed/hr?	10	4	1

23	The following observations were recorded during a test on a 4-stroke engine. Bore = 25cm, stroke=40cm, crank speed=250 rpm, net load on the brake drum=700N, diameter of brake drum=2m, indicated mean effective pressure=6bar, fuel consumption = 0.0013kg/s, specific gravity of fuel=0.78, calorific value of fuel=43900kJ/kg. Estimate (i) BP, (ii) IP, (iii) FP, and (iv) mechanical efficiency (v) indicated and brake thermal efficiency.	12	4	1
24	The following are the details of a 4-stroke petrol engine. (i) diameter of brake drum=60.03cm, (ii) full brake load on drum=250N, (iii) brake drum speed = 450 rpm, (iv) calorific value of petrol = 40MJ/kg, (v) brake thermal efficiency=32%, (vi) mechanical efficiency=80%, specific gravity of petrol=0.82. How would you evaluate – (i) brake power, (ii) indicated power, (iii) fuel consumption in liter per second, and (iv) indicated thermal efficiency?	12	4	1
25	A four-cylinder two-stroke petrol engine develops 30kW at 2500 rpm. The mean effective pressure on each piston is 8bar, and mechanical efficiency is 80%. Determine the diameter and stroke of each cylinder, stroke to bore ratio is 1.5. Also estimate the fuel consumption if brake thermal efficiency is 28%. The calorific value of fuel is 43900 kJ/kg.	10	4	1
26	A person conducted a test on a single cylinder two-stroke petrol engine and found that the mechanical efficiency and brake thermal efficiency of the engine are 0.7 and 0.2 respectively. The engine with a mean effective pressure of 6bar ran at 300 rev/min consuming fuel at a rate of 2.2kg/hr. Given that the calorific value of fuel is 42500 kJ/kg and that the stroke to bore ratio of the engine is 1.2, estimate the bore and stroke of the engine.	10	4	1

Module – 3 : Machines and Machine Tools				
	QUESTION	**MARKS**	**LEVEL**	**Co.'s**
1	Can you propose an alternative option, when the drill machine in the machine shop is out of order, for making a hole of dia 20 mm in a cylindrical block of dia 40 mm and length 30mm? Write the detailed procedure	10	5	2
2	What would happen if one of the cutting edges of the milling machine will be broken while doing the milling operation. Analyze all possibilities	8	5	2
3	What machining operations will you recommend for a requirement " making a very fine flat steel surface with surface finish of 8 microns or better ". Write the operations in detail	12	6	2
4	What are the parts of a lathe machine	10	4	
5	What are the types of classifications used for machine tools? Discusses about three type of classification in detail	10	4	2

6	Can you list the parts of milling machine? Also explain the function of four parts	10	4	2
7	Can you list the components of Lathe machine and also write about classifications of lathe machine	10	4	2
8	Can you elaborate the working principle of Lathe machine?	10	5	2
9	Can you list the steps used for taper turning by swiveling the compound tool rest. Explain with a sketch the principle		4	2
10	Describe the working principle of Lathe.	4	3	2
11	With neat sketches, explain the following lathe operations: (a)Facing (b) Cylindrical Turning (c) knurling,(d) thread cutting	10	3	2
12	How would you differentiate between facing and turning operation?	8	4	2
13	Explain the difference between facing and turning operations.	6	2	2
14	How would you classify the drilling machine?	4	2	2
15	With suitable sketches, explain the following drilling machine operations: (a) counter sinking and (b) counter boring (c) Reaming (d) tapping (e) boring (f) spot facing	12	3	2
16	How would you justify the requirement of a bench drilling machine?	10	3	2
17	With a neat sketch explain radial drilling machine.	10	4	2
18	Can you explain how the important specifications of Lathe machine is useful for choosing a lathe machine	6	2	2
19	With a neat sketch describe the specification of drilling machine.	6	2	2
20	Describe in detail the components of drilling machine and its classification.	8	3	2
21	Explain the components of milling machine and its classification.	8	1	2
22	Can you explain the working principle of vertical milling machine?	10	3	2
23	Explain the working principle of horizontal milling machine	10	4	2
24	With neat sketches explain (a) plane milling (b) End milling (c)Slot milling (d) angular milling (e) Form milling	10	5	2
25	What is the difference between up milling and down milling?	6	1	2
26	Can you explain the requirement of important specifications of a milling machine with a neat sketch.	6	4	2

Module-4 : Joining processes and Robotics				
No.	**QUESTION**	**Marks**	**Blooms level**	**Co's**
1	Categorize and explain the metal joining processes	10	5	3
2	Classify consumable and non-consumable Electrodes.	8	2	3
3	With the help of necessary sketches explain the principle of arc welding	10	3	3
4	Why do you think electrodes are coated?	5	4	3
5	Sketch and explain Oxy-acetylene welding.	12	1	3
6	Explain the flame characteristics in oxy-acetylene welding with	11	2	3

	a neat sketch.			
7	Classify arc welding and gas welding.	12	4	3
8	Explain Soldering. What fluxes are commonly used in soldering? Comprehend why is flux necessary?	14	2	3
9	Critique the advantages and limitations of brazing over soldering.	8	5	3
10	Define a robot. Comprehend different types of robot configurations.	10	4	3
11	State advantages and limitations of robots.	8	4	3
12	Summarize the applications of robots	8	5	3

Module 5 : Refrigeration				
	QUESTION	**MARKS**	**YEAR**	**Co.'s**
1	Explain the basic concepts of refrigeration.	4	4	4
2	What is the principle of refrigeration? Name the essential parts of refrigerator and briefly explain their functions.	8	4	4
3	Mention some commonly used refrigerants and their uses.	5	5	4
4	Define Refrigeration and air conditioning. List out the desirable properties of a good refrigerant.	6	5	4
5	What are the desirable properties of a good refrigerant	5	5	4
6	List the five commonly used refrigerants with their boiling points.	6	3	4
7	List the uses of Refrigeration.	5	2	4
8	Define the following: (a) COP (b) Refrigeration effect (c) Ton of refrigeration (d) Ice making capacity (e) Relative COP,	10	2	4
9	Define Refrigeration effect and co-efficient of performance of a refrigeration system. What is the commonly used unit for capacity of a refrigeration system? Explain how its value used is calculated in SI units	10	2	4
10	Explain with neat sketch working principle of Vapour compression refrigeration.	10	2	4
11	Name the various parts of a Vapour compression refrigerator and briefly explain with a flow diagram their functions.	8	2	4
12	Explain the working principle of Vapour absorption refrigeration process with neat sketch.	10	2	4
13	List the difference between Vapour compression refrigerator and Vapour absorption refrigerator.	6	3	4
14	Define: WBT, DBT, Specific Humidity, and Relative Humidity.	8	2	4
15	Explain the requirements of air conditioning system.	6	2	4
16	What is psychometric chart? Explain the components of psychometric chart.	10	2	4
17	Write short notes on air conditioning.	5	2	4
18	List the various applications of air conditioning.	5	2	4
19	Explain room air Conditioner system with neat sketch	10	2	4
20	What is air conditioning? How is it classified? What is its application? With a suitable diagram show the flow path of 4refrigerant used in any air conditioner.	8	3	4
21	Distinguish between refrigeration and air conditioning.	6	3	4