Code No: **20ME5T01**

R20

III B. TECH I SEMESTER REGULAR EXAMINATIONS, NOVEMBER - 2022
DESIGN OF MACHINE MEMBERS– II
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 70**

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

~~~~~~

UNIT-I

1.	a)	Differentiate sliding contact and rolling contact bearings.	5 M
	b)	A full journal bearing operating under a steady load has the following specifications: journal diameter = 60 mm, bearing length = 60 mm, radial load on bearing = 2.8 kN, journal speed = 1020 rpm, radial clearance = 0.05 mm, viscosity of oil = $80x10^{-9}$ N-s/mm^2, density of oil = 860 kg/m^3, specific heat of oil = 1.76 kJ/kg-^{o}C. Determine (i) Sommerfield number (ii) Power loss in friction (iii) Temperature rise if heat generated is entirely carried by oil (iv) Minimum film thickness.	9 M

(OR)

2.	a)	Hydrodynamic bearing is called "self-acting" bearing. Justify the statement.	5 M
	b)	A single row deep groove ball bearing is subjected to a radial force of 8kN and thrust force of 3 kN. The values of X and Y factors are 0.56 and 1.5 respectively. The shaft rotates at 1200 rpm. The diameter of shaft is 75 mm and bearing number 6315 (C = 112000 N) is selected for this application. (i) Estimate the life of bearing with 90% reliability, (ii) Estimate the reliability for 20000 hrs. life	9 M

UNIT-II

3.	a)	Explain the forces acting on connecting rod?	4M
	b)	Design a side crankshaft for a 500 mm × 600 mm gas engine. The weight of the flywheel is 80 kN and the explosion pressure is 2.5 N/mm^2. The gas pressure at maximum torque is 0.9 N/mm^2 when the crank angle. is 30°. The connecting rod length is 4.5 times of the crank radius. Any other data required for the design may be assumed.	10M

(OR)

4.	a)	Design cross section of the connecting rod of a petrol engine running at 1200 rpm for the following data: diameter of piston = 90 mm, length of connecting rod = 300 mm, stroke = 90 mm, mass of reciprocating parts = 2.25 kg, the maximum explosion pressure = 2.2 MPa. The rod is of I-section of width 4t and depth equal to 5t where t is the thickness of a web and flanges. The material of connecting rod is steel for which yield stress in compression is 330 MPa. Take factor of safety equal to 5 and E = $2.1x10^5$MPa. Rankine constant = $\frac{1}{7500}$.	10M
	b)	Mention the applications of over hung crank shafts?	4 M

UNIT-III

5.	a)	What are the functions of compression piston rings?	4 M
	b)	A four-stroke diesel engine has the following specifications: Brake power=5 kW; speed=1200 rpm; Indicated mean effective pressure=0.35 N/mm^2; Mechanical efficiency=80%. Determine: (i) Bore and length of the cylinder; (ii) Thickness of the cylinder head; and (iii) Size of studs for the cylinder head.	10M
~~~~~~

(OR)

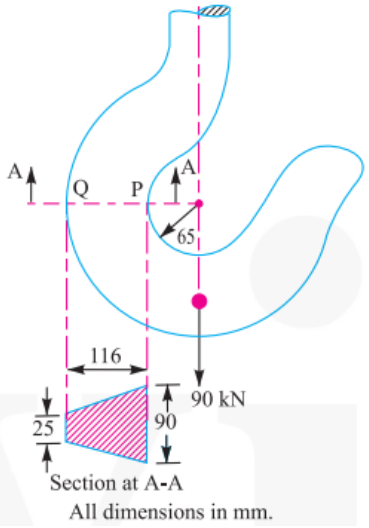
6. a) Design a cast iron piston for a single acting four stroke engine for the following data: Cylinder bore = 100 mm; Stroke = 125 mm; Maximum gas pressure = 5 N/mm^2 ; Indicated mean effective pressure = 0.75 N/mm^2 ; Mechanical efficiency = 80% ; Fuel consumption = 0.15 kg per brake power per hour ; Higher calorific value of fuel = 42 × 10^3 kJ/kg ; Speed = 2000 rpm. Any other data required for the design may be assumed. 10M

b) Explain different types of cylinder liners used. 4 M

UNIT-IV

7. a) Discuss the bending stresses induced in curved beams. 4 M

b) A crane hook has a trapezoidal section at A-A as shown. Find the maximum stress at the points P and Q. 10M



(OR)

8 It is to required to select a flat belt drive for a compressor running at 720 rpm, which is driven by a 25 kW, 1440 rpm motor. The space is available for a centre distance of 3 m. The belt is open type. 14M

UNIT-V

9. a) Derive an expression for beam strength of a spur gear tooth (Lewi's equation) using standard notations. 5 M

b) Design a pair of helical gears to transmit 30kW power at a speed reduction ratio of 4:1. The input shaft rotates at 2000 rpm. Take helix and pressure angles equal to 25°and 20°respectively. The number of teeth on the pinion may be taken as 30. Assume the material and necessary parameters. 9 M

(OR)

10. a) It is required to design a pair of spur gears with 20^o full depth involute consisting of a 20 teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 22.5 kW, 1450 rpm electric motor. The material for the pinion is plain carbon steel FG410 (σ_{ut}=410 N/mm^2) while the gear is made of grey cast iron FG200 (σ_{ut}=200 N/mm^2). Design the gears based on Lewis equation and velocity factor to account for the dynamic load. 10M

b) Write expressions for static strength, limiting wear load and dynamic load for helical gears. 4 M

* * * * *