

ANURAG Engineering College
(An Autonomous Institution)

III B.Tech II Semester Regular/ Supplementary Examinations, June/July – 2024
DESIGN OF MACHINE MEMBERS-II
(MECHANICAL ENGINEERING)

Time: 3 Hours

Max. Marks: 75

Section – A (Short Answer type questions)**(25 Marks)****Answer All Questions**

Course Outcome	B.T Level	Marks
CO1	L1	2M
CO1	L1	3M
CO2	L2	2M
CO2	L2	3M
CO3	L1	2M
CO3	L2	3M
CO4	L1	2M
CO4	L1	3M
CO5	L1	2M
CO5	L1	3M

1. What do you mean by hydrodynamic lubrication?
2. What are rolling contact bearings?
3. Why are ball bearings preferred to journal bearings for a shaft mounted on a gear box?
4. Explain briefly about the static loading of ball and roller bearing.
5. Name the materials used for piston ring
6. Enumerate the design considerations for crank pin.
7. What is meant by creep of a belt and what is its effect.
8. What are the simple and duplex rollers chains?
9. What is law of gearing?
10. What is a herringbone gear? Where they are used?

Section B (Essay Questions)**Answer all questions, each question carries equal marks.****(5 X 10M = 50M)**

11. A) Design a journal bearing for a centrifugal pump running at 1440 r.p.m. The diameter of the journal is 100 mm and load on each bearing is 20 kN. The factor ZN/p may be taken as 28 for centrifugal pump bearings. The bearing is running at 75°C temperature and the atmosphere temperature is 30°C . The energy dissipation coefficient is $875 \text{ W/m}^2/^{\circ}\text{C}$. Take diametral clearance as 0.1 mm.

OR

- B) i) What procedure would you follow while designing a journal bearing? Explain.
ii) Each bearing of an electrical motor sustains a radial load of 4 kN. Assuming (l/d) ratio of 1.1, determine the length of the bearing, if the permissible bearing pressure is limited to 1 N/mm^2 .

12. A) i) Define dynamic load carrying capacity of rolling contact bearing.
ii) The radial load acting on a ball bearing is 2500 N for the first 5 revolutions and reduces to 1500 N for the next ten revolutions. The load variation then repeats itself. The expected life of the bearing is 20 million revolutions. Determine the dynamic load carrying capacity of the bearing.

OR

- B) A ball bearing operates on the following work cycle:

Element No	Radial load (N)	Speed (RPM)	Element time (%)
1	3000	720	30
2	7000	1440	40
3	5000	900	30

The dynamic load capacity of the bearing is 16600N. Calculate i) The average speed of rotation; ii) The equivalent radial load iii) the bearing life.

13. A) Design an aluminum alloy piston for a single acting four stroke engine for the following: Specifications: Cylinder bore = 0.30 m, Stroke = 0.375 m, Maximum gas pressure = 8 N/mm² Brake mean effective pressure = 1.15 MPa, Fuel consumption = 0.22 kg/KW/hr Speed = 500 rev/min. CO3 L3 10M
- OR**
- B) 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/mm², Indicated mean effective pressure = 0.75 N/mm², Mechanical efficiency = 80%, fuel consumption = 0.15 kg/break power/ hour, higher calorific value of fuel = 42x10³ kj/kg, speed = 2000 rpm, Any other data required for the design may be assumed. CO3 L3 10M
14. A) A compression spring of spring constant K is cut into two springs having equal number of turns and the two springs are then used in parallel. What is the resulting spring constant of the combination? How does the load carrying capacity of the resulting combination compare with that of the original spring. CO4 L3 10M
- OR**
- B) It is required to select a flat-belt drive to connect two transmission shafts rotating at 800 and 400 rpm respectively. The centre to centre distance between the shafts is approximately 3 m and the belt drive is open-type. The power transmitted by the belt is 30 kW and the load correction factor is 1.3. The belt should operate at a velocity between 17.8 to 22.9 m/s. The power transmitting capacity of the belt per mm width per ply at 180° arc of contact and at a belt velocity of 5.08 m/s is 0.0147 kW. Select preferred pulley diameters and specify the belt. CO4 L3 10M
15. A) A pair of helical gears consists of an 18 teeth pinion meshing with a 45 teeth gear. 7.5 kW power at 2000 rpm is supplied to the pinion through its shaft. The normal module is 6 mm, while the normal pressure angle is 20°. The helix angle is 23°. Determine the tangential, radial and axial components of the resultant tooth force between the meshing teeth. CO5 L3 10M
- OR**
- B) It is required to design a pair of spur gears with 20° full-depth involute teeth consisting of a 20- teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 25 kW, 1440 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe410, while the gear is made of grey cast iron FG 200. The factor of safety is 2. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load. CO5 L3 10M