R16

Code No: 136BA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2019
DESIGN OF MACHINE MEMBERS - II
(Mechanical Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a)	What are journal bearings? Give a classification of these bearings.	[2]
b)	Explain with sketches the working of different types of thrust bearing.	[3]
c)	What are rolling contact bearings?	[2]
d)	Write short note on classifications and different types of antifriction bearings.	[3]
e)	Explain the various types of crankshafts.	[2]
f)	Discuss the materials commonly used for making the valve of an I. Engine.	[3]
g)	Discuss the different types of belts and their material used for power transmission.	[2]
h)	Discuss the materials and practical applications for the various types of springs.	[3]
i)	What is a herringbone gear? Where they are used?	[2]
j)	Write a short note on gear drives giving their merits and demerits.	[3]

PART - B

(50 Marks)

2. 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 75^0C temperature and the atmosphere temperature is 30^0C. The energy dissipation coefficient is 875 W/m2/^{0}C. Take diametral clearance as 0.1 mm. [10]

OR

3. A wall bracket supports a plummer block for 80 mm diameter shaft. The length of bearing is 120 mm. The cap of bearing is fastened by means of four bolts, two on each side of the shaft. The cap is to withstand a load of 16.5 kN. The distance between the centre lines of the bolts is 150 mm. Determine the thickness of the bearing cap and the diameter of the bolts. Assume safe stresses in tension for the material of the cap, which is cast iron, as 15 MPa and for bolts as 35 MPa. Also check the deflection of the bearing cap taking E = 110 kN / mm^2. [10]

4.a) A ball bearing subjected to a radial load of 4000 N is expected to have a satisfactory life of 12 000 hours at 720 r.p.m. with a reliability of 95%. Calculate the dynamic load carrying capacity of the bearing, so that it can be selected from manufacturer's catalogue based on 90% reliability. If there are four such bearings each with a reliability of 95% in a system, what is the reliability of the complete system?

b) Explain how the following factors influence the life of a bearing:
(i) Load (ii) Speed (iii) Temperature (iv) Reliability. [6+4]

OR

5.a) A single row deep groove ball bearing operating at 2000 r.p.m. is acted by a 10 kN radial load and 8 kN thrust load. The bearing is subjected to a light shock load and the outer ring is rotating. Determine the rating life of the bearing.

b) Select appropriate type of rolling contact bearing under the following condition of loading giving reasons for your choice. [6+4]
i) Light radial load with high rotational speed.
ii) Heavy axial and radial load with shock.

6. A four stroke internal combustion engine has the following specifications: Brake power = 7.5 kW; Speed = 1000 r.p.m.; Indicated mean effective pressure= 0.35 N/mm^2; Maximum gas pressure = 3.5 N/mm^2; Mechanical efficiency = 80 %. Determine:
a) The dimensions of the cylinder, if the length of stroke is 1.4 times the bore of the cylinder; b) Wall thickness of the cylinder, if the hoop stress is 35 Mpa; c) Thickness of the cylinder head and the size of studs when the permissible stresses for the cylinder head and stud materials are 45 Mpa and 65 Mpa respectively. [10]

OR

7. Design a plain carbon steel centre crankshaft for a single acting four stroke, single cylinder engine for the following data:
Piston diameter = 250 mm; Stroke = 400 mm; Maximum combustion pressure = 2.5 N/mm^2; Weight of the flywheel = 16 kN; Total belt pull = 3 N; Length of connecting rod = 950 mm. When the crank has turned through 30^0 from top dead centre, the pressure on the piston is 1 N/mm^2 and the torque on the crank is maximum. Any other data required for the design may be assumed. [10]

8.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?

b) Explain, with the help of neat sketches, the types of various flat belt drives. [6+4]

OR

9. Design a flat belt drive to transmit 110 kW at a belt speed of 25 m/s between two pulleys of diameters 250 mm and 400 mm having a pulley centre distance of 1 metre. The allowable belt stress is 8.5 Mpa and the belts are available having a thickness to width ratio of 0.1 and a material density of 1100 kg/m^3. Given that the coefficient of friction between the belt and pulleys is 0.3, determine the minimum required belt width. What would be the necessary installation force between the pulley bearings and what will be the force between the pulley bearings when the full power is transmitted? [10]

10.a) Design and draw a spur gear drive transmitting 30 kW at 400 r.p.m. to another shaft running approximately at 100 r.p.m. The load is steady and continuous. The materials for the pinion and gear are cast steel and cast iron respectively. Take module as 10 mm. Also check the design for dynamic load and wear.

b) Write the expressions for static strength, limiting wear load and dynamic load for helical gears and explain the various terms used therein. [6+4]

OR

11. A motor shaft rotating at 1500 r.p.m. has to transmit 15 kW to a low speed shaftwith a speed reduction of 3:1. The teeth are $14^{1/2^\circ}$ involute with 25 teeth on the pinion. Both the pinion and gear are made of steel with a maximum safe stress of 200 MPa. A safe stress of 40 Mpa may be taken for the shaft on which the gear is mounted and for the key. Design a spur gear drive to suit the above conditions. Also sketch the spur gear drive. Assume starting torque to be 25% higher than the running torque. [10]