

R16

Code No: 136BA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, March - 2024

DESIGN OF MACHINE MEMBERS – II

(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) Define the term 'Bearing Life'. [2]
- b) Explain various engineering applications of sliding contact bearings. [3]
- c) Explain briefly about the static loading of ball and roller bearing. [2]
- d) Write short note on classifications and different types of anti-friction bearings. [3]
- e) What is the function of connecting rod of IC engine? [2]
- f) What is the function of the piston and materials used for piston? [3]
- g) Write advantages of belt drives over rope drive. [2]
- h) Sketch the cross section of a V belt and label its important parts. [3]
- i) Define module and diameters pitch. [2]
- j) Define the terms i) pressure angle ii) circular pitch. [3]

PART – B

(50 Marks)

- 2.a) What are bearing material and desirable properties of a good bearing material?
- b) What are the various terms using the journal bearings analysis and design? Give their definitions in brief. [5+5]

OR

- 3.a) Formulate the heat generated and dissipated in a journal bearing.
- b) A 250×250 mm bearing carries a load of 108 kN. The bearing rotates at 1500 rpm. The clearance ratio is 670. For full journal bearing the power lost in friction is 14.36 kW. Find the viscosity of the oil. [5+5]

- 4.a) What are rolling contact bearings? Discuss their advantages over sliding contact bearings.
- b) Select a single row deep groove ball bearing for a radial load of 4000N and an axial load of 5000N, operating at a speed of 1600rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load. [5+5]

OR

5. A shaft is mounted on two roller bearings, which are 350 mm apart. The shaft carries a bevel gear at the middle. At a shaft speed of 900 rpm; the gear forces are: radial load = 10 kN, and thrust load = 3.5 kN. Determine the rated dynamic capacity of the bearing, for a desired life of 10,000 hours. The service factor is 1.5, thrust factor is 0.67 and radial load factor is 0.67. [10]

6. Design a cast iron piston for a four stroke IC engine for the following specifications.

Cylinder bore=120 mm
Stroke length=150 mm
Maximum gas pressure=5 MPa
Brake mean effective pressure=0.7 MPa
Fuel consumption=0.25 Kg/kW/hr
Speed=2400 rpm
Assume any other data necessary for the design.

[10]

OR

7. The following data is given for a connecting rod:

Engine speed =1500 rpm
Length of connecting rod=320 mm
Length of stroke=140 mm
Density of the material=7830 Kg/m³
Thickness of web flanges= 6 mm

The cross section of the connecting rod is I section.

Upper and bottom flange dimensions are = 4mm

Web dimensions are = 3mm

Calculate the whipping stress in connecting rod.

[10]

8. A V-belt is required for a 15 kW, 1440 rpm electric motor, which drives a centrifugal pump running at 360 rpm, for a service of 24 hrs per day. From space considerations, the center distance should be approximately 1 m, Determine: a) belt specifications, b) number of belts, c) correct center distance, and d) pulley diameters. [2+3+2+3]

OR

9. It is required to select a v-belt drive to connect a 20 kw, 1440 rpm motor to a compressor running at 480 rpm for 15 hours per day. Space is available for a center distance approximately 1.2m. Determine a) The specifications of the belt b) Diameter of the motor and compressor pulleys c) The correct center distance and the number of belts. [4+3+3]

10. A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4 : 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. [10]

OR

11. A gear drive is required to transmit a maximum power of 22.5kW. The velocity ratio is 1:2 and pinion speed is 200 rpm. The approximate center distance between the shafts may be taken as 600mm. The teeth have 20° stub involute profiles. The static stress for the gear material (CI) is 60MPa and face width as 10 times the module. Find the module, Face width and number of teeth on each gear. Check the design for dynamic loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and combination factor for the wear as 1.4. [10]

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