VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD
B.E. (Mech. Engg.: CBCS) V–Semester Supplementary, May/June-2019
Machine Design

Time: **3** hours

Max. Marks: **70**

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

1. Classify various types of springs and mention their applications.

2. What is meant by nipping of leaf springs?

3. State the classification of Gears.

4. Define the terms pitch circle diameter, angle of obliquity and module.

5. Distinguish between hydrostatic and hydrodynamic lubrication.

6. A deep groove ball bearing rotating at 1200 r.p.m. is subjected to radial and an axial force of 2000 N and 1500 N respectively. What will be the basic dynamic capacity of bearing if 20,000 hours is the rating life? Consider radial factor = 0.55, Thrust factor = 2 & application factor = 1.5.

7. Mention the factors to be considered while designing a piston for an I.C Engine.

8. Name the stresses that should be considered while designing a connecting rod of an I.C Engine.

9. List the factors to be considered while designing a crane hook.

10. Mention the applications of a machine frames and C-Clamp.

Part-B (5 × 10 = 50 Marks)

11.a) Determine the maximum shearing stress and elongation in a helical steel spring composed of 20 turns of 20-mm-diameter wire on a mean radius of 90 mm when the spring is supporting a load of 1.5 kN. Use G = 83 GPa. [5]

  b) Design a leaf spring for the following specifications : [5]
  Total load = 140 kN ; Number of springs supporting the load = 4 ; Maximum number of leaves= 10; Span of the spring = 1000 mm ; Permissible deflection = 80 mm. Take Young's modulus, E = 200 kN/mm2 and allowable stress in spring material as 600 MPa.

12.a) Write the design considerations of a gear drive. [3]

  b) 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. [7]

13.a) List the assumptions made in the Hydrodynamic lubricated bearings. [3]

  b) Design a journal bearing for a centrifugal pump from the following data : [7]
  Load on the journal = 20 000 N; Speed of the journal = 900 R.P.M.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg / m-s; Ambient temperature of oil = 15.5°C ; Maximum bearing pressure for the pump = 1.5 N / mm2. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m2/°C.

14.a) Name the different types of forces acting on a connecting rod [3]

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/mm2. The gas pressure at maximum torque is 0.9 N/mm2 when the crank angle. is 30°. The connecting rod is 4.5 times the crank radius. Any other data required for the design may be assumed. [7]

15.a) Discuss why the trapezoidal cross section of a crane hook is preferred over a rectangular cross section. [4]

b) Design "C" clamp frame for a total clamping force of 20 kN. The cross-section of the frame is rectangular and width to thickness ratio is 2. The distance between the load line and natural axis of rectangular cross section is 120 mm and the gap between two faces is 180 mm. The frame is made of cast steel for which maximum permissible tensile stress is 100 N/mm^2 [6]

16.a) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2, find the axial load which the spring can carry and the deflection per active turn [7]

b) Mention the advantages of worm gears. [3]

17. Answer any *two* of the following:

a) What is meant by Bearing Characteristic Number and Bearing Modulus for Journal Bearings? [5]

b) Briefly describe the design procedure of Piston head and Piston pin. [5]

c) Mention the design considerations of a machine frame. [5]

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