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06ME/AU61

Sixth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Design of Machine Elements – II

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, selecting at least TWO questions from each part.
 2. Use of design data hand book is permitted.
 3. Missing data, if any, may suitably be assumed.

PART – A

- 1
 - a. What are the assumptions made in the stress analysis of curved beam? (04 Marks)
 - b. List out the differences between straight and curved beam. (04 Marks)
 - c. Compute the maximum stress at the inner and outer fibres in the critical section of a crane hook which is required to lift loads upto 25 kN. The hook has trapezoidal section with parallel sides 60 mm and 30 mm, the distance between them being 90 mm. The inner radius of hook is 100 mm. The load line is nearer to the inner surface of the hook by 25 mm than the centre of curvature at the critical section. (12 Marks)

- 2
 - a. State assumption made in derivation of Lamé's equation. (04 Marks)
 - b. With reference to pressure vessels, what is autofrettage? Explain. (04 Marks)
 - c. The cylinder of a stationary engine is 120 mm in diameter and is held to the crank case by M12 × 1.75 Cr-Ni steel bolts. The maximum gas pressure in the cylinder is 3.5 MPa. Assume the ultimate strength of this steel as 800 MPa and yield stress as 600 MPa. Determine the number of bolts required. Take gasket factor $r = 0.75$. (12 Marks)

- 3
 - a. Derive the expression for the shear stress induced in helical coil spring. (05 Marks)
 - b. A railway Wagon weighing 50 kN and moving with a speed of 8 km/hr has to be stopped by four buffer springs in which the maximum compression allowed is 220 mm. Find the number of turns of coils in each spring of mean diameter 150 mm. The diameter of spring wire is 25 mm. Take $G = 84$ GPa. Also find the shear stress. (15 Marks)

- 4

Design a pair of helical gears to transmit power of 15 KW at 3200 rpm with speed reduction 4:1. Pinion is made of cast steel 0.4% C untreated. Gear made of high grade C.I. Helix angle is limited to 26° and not less than 20 teeth are to be used on either gear. Suggest suitable surface hardness for the gear pair. Need not show calculation of dimensions of gear. (20 Marks)

PART – B

- 5
 - a. Derive an expression for the formative number of teeth for bevel gear. (05 Marks)
 - b. A pair of bevel gears are used to transmit a power of 25 KW from a shaft rotating at 1200 rpm to a perpendicular shaft to be rotated at 400 rpm. Determine: (i) Module, (ii) Dynamic load. (15 Marks)

- 6 a. With the help of a neat sketch derive an equation for torque transmitting capacity of single plate clutch, considering uniform wear theory. (05 Marks)
- b. Fig.Q6(b) shows a double shoe brake on a drum diameter of 320 mm. the angle of contact of each shoe $\approx 110^\circ$. The brake has to absorb 10 KW at 1000 rpm. Design the brake and determine the spring force. The brake lever is rectangular cross section whose height is 3 times its width, $\mu = 0.42$.

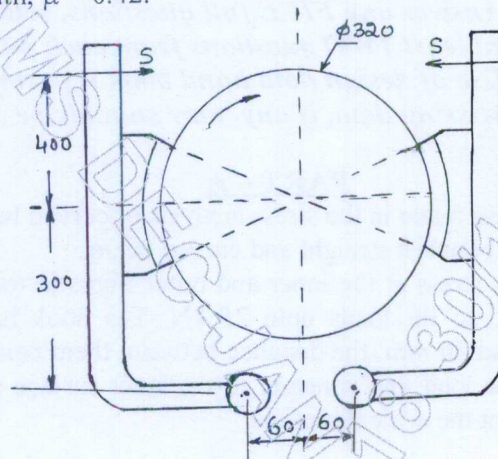


Fig.Q6(b)

(15 Marks)

- 7 a. State requirement of good lubricant. (05 Marks)
- b. Derive Petroff's equation for a lightly loaded bearing. (05 Marks)
- c. A 75 mm long full journal bearing of diameter 75 mm supports a load of 10 kN. The speed of the journal is 1200 rpm. The absolute viscosity of the oil is 10×10^{-3} Pas and diametral clearance ratio is 0.001. Determine the coefficient of friction by using Petroff's equation and McKee's equation. (10 Marks)
- 8 a. Derive the expression for the ratio of tensions in belt drive with the effect of centrifugal tension. (10 Marks)
- b. Select a wire rope to lift a load of 10 kN through a height of 600 m from a mine. The weight of bucket is 2.5 kN. The load should attain a maximum speed of 50 m/min in 2 seconds. (10 Marks)
