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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester, B.E. - Mechanical Engineering

Semester End Examination; June - 2016

Design of Machine Elements - II

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Any missing data may be suitably assumed.

UNIT - I

1 a. Derive an expression for Max. stress induced in helical spring. Also derive expression for deflection in helical spring. 10

b. A helical spring is to be designed for operating valve in the load range of 150 N to 100 N. The load when the valve is closed is 150 N and is 100 N when the valve is open. The deflection of the spring for the above load range is 8 mm. Assuming severe services and C = 10. Design the spring completely. 10

2 a. Explain the terms Nip and surge in springs. Also discuss the methods to eliminate surge in springs. 10

b. Determine the load to be applied at the top of the coil spring to get a deflection of 40 mm. The details of the spring are D = 76.8 mm and d = 13.2 mm, i = 18. Determine the deflection in the leaf spring and also determine the max stress induced. 10

UNIT - II

3 a. A stainless steel pipe of 150 mm internal diameter is subjected to internal pressure of 10 MPa. The pipe is made of steel whose tensile strength at the yield point is 240 N/mm^2 and the factor of safety is 3. Poisson's ratio of the material is 0.27. Determine the wall thickness of the pipe. 8

b. A 440 mm outer diameter, 250 mm inner diameter and 300 mm long steel hub is to be shrink on to a 250 mm diameter steel shaft. If the torque to be transmitted is 300 kN-m and $\mu = 0.18$. Determine the amount of interference required. 12

4 a. Discuss about Autofrettage. 6

b. A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm^2. Calculate the tangential and radial stresses at the inner, middle and outer surface. 14

UNIT - III

5. Design a pair of spur gear to transmit 20 kW from a shaft rotating at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume C – 40 steel untreated for pinion and cast steel 0.2% C. untreated for gear. Take; 20^o full depth as gear profile and assume medium shocks 8 - 10 hrs per day. Check for dynamic load. 20

Contd…2

6. Design completely a pair of helical gear to transmit 50 kW. The pinion is rotating at 1500 rpm the gear has a velocity ratio of 4.25: 1 with $\beta = 15^o$. Consider heavy shock loads 2 hr/day. Take; C-40 steel (untreated) as material for pinion and CI grade 35 (heat treated) for gear. Also assume pressure angle of 20^o full depth. 20

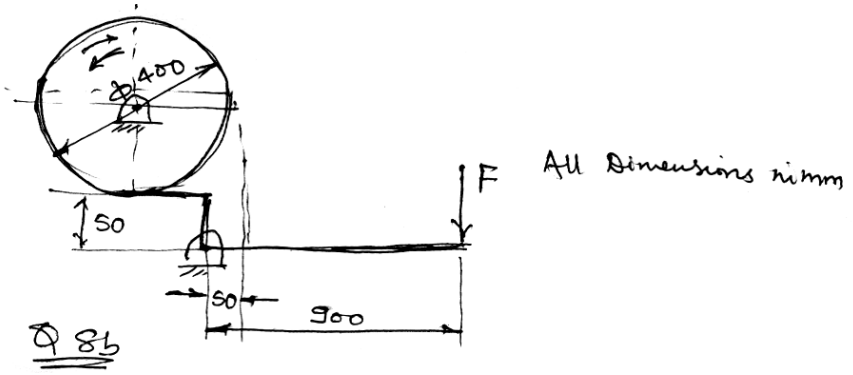
UNIT - IV

7 a. Name different type of clutches. Describe with the help of neat sketch the working principle of any one friction clutch. 6

b. A single plate friction clutch of both sides effective has 0.3 m outer diameter and 0.16 m inside diameter. The coefficient of friction is 0.2 and it runs and 1000 rpm. Find the power transmitted for uniform wear and uniform pressure distribution cases. If the maximum allowable pressure is 0.08 MPa. 14

8 a. Classify the brakes and name different types of mechanical brakes. 4

b. The torque absorbed in the band brake shown in figure is 400×10^3 N-mm. Design the band and lever taking $\mu = 0.27$ and diameter of drum as 400 mm. The allowable stress in band may be taken as 70 MPa. 16



UNIT - V

9 a. Explain: i) Bearing characteristic number ii) Somerfield Number 8

b. Design a suitable journal bearing for shaft of 75 mm diameter rotating at 1800 rpm and carrying a load of 12 kN. The operating temperature of oil is 70ºC and ambient temperature is 25ºC. The bearing is to be lubricated with viscosity of 0.01 kg/ms at 70ºC check the bearing for artificial cooling. Assume; L/D = 1 and take D/C = 1000. 12

10 a. List the factors that influence the selection of rolling contact bearing or Journal bearing. 12

b. An SKF self aligned ball bearing No. 1310 has a specific dynamic capacity C = 33.5 kN. If the equivalent radial load actually applied to the bearing is P = 44.5 kN determine;

i) Life in Millions of revolutions when the speed of rotating bearing is 1800 rpm. 8

ii) Life in hours for 90% of the bearing and

iii) The average life in hours that can be expected.

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