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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/July - 2015

Design of Machine Elements - II

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.*
ii) Use of Design data handbook is permitted.
iii) Any missing data required may be suitably assumed.

PART - A

1 a. Derive the bending stress equation for curved beams. State the assumptions made. 10

b. An open ring is formed from a 100 mm diameter. The inside diameter of the ring is 120 mm and load of 25 kN is applied through vertical diameter of the ring. Determine the value of stress at critical section. 10

2 a. A cast steel crank is to be shrunk on a 250 mm steel shaft. The outside diameter of the crank hub is 444.5 mm. The maximum tangential. Stress in the hub is limited to 150 MPa. The Co-efficient of friction between the hub and shaft is 0.15. Take $E = 2x10^5$ MPa. Determine,

i) Required bore of the crank 10

ii) Probable value of normal pressure between the hub and shaft

iii) Torque that may be transmitted withought using key. If the hub length is 75 mm. Take; $\mu = 0.3$

b. A C.I cylinder inside diameter 160 mm is subjected to a pressure of 15 N/mm^2. The permissible working stress may be taken as 25 MPa for CI. If the cylinder is closed by means of flat head cast integral with cylinder walls. Find the thickness of the cylinder wall and the head. 10

3 a. Explain the commonly used spring materials. 4

b. A helical spring is made from a wire of 6 mm diameter and has an outside diameter of 75 mm. If permissible shear stress is 350 MPa and modulus of rigidity is 84 kN/mm^2. Find the axial load which the spring can carry and the deflection per active turn. 10

c. Show that stress induced in constant width spring is 50% greater than constant strength spring. 6

4 a. Determine the power transmitted by a single pair plate clutch; the friction surfaces have an outside diameter of 350 mm and inner diameter of 280 mm. The co-efficient of friction is 0.25 and maximum allowable pressure is 0.85 MPa. Assume shaft rotating at 1000 rpm. 10

Contd…2

b. A simple band brake of drum diameter 600 mm has a band passing over it with angle of contact 225º, while one end is connected to the fulcrum. The other end is connected to the brake lever at a distance of 400 mm from the fulcrum. The brake lever is 1m long. The brake is to absorb a power of 15 kW at 720 rpm. Design the brake lever of rectangular cross section, assuming depth to be thrice the width. Take allowable stress is 80 MPa. Take $\mu = 0.3$ — 10

PART - B

5. A cast steel spur gear pinion having 21 teeth and rotating at 1500 rpm is required transmit 9kw to a high grade CI gear to run at 500 rpm. The teeth are 14½ involutes form. Design the gears completely. The material properties are σ_{all} for pinion is 138.3 N/mm^2 and σ_{all} for gear is 78.5 N/mm^2. Assume medium shock and 10 hrs/day service, Face width is 10 times module — 20

6. Design a worm gear drive to transmit 2 kW at 1000 r.p.m. of the worm. The desired velocity ratio is 15 : 1. The centre distance of the drive should be around 200 mm. Design the gear for the strength. — 20

7 a. Derive the Petroff's equation with assumptions. — 10

b. A 75 mm long full journal bearing of diameter 75 mm supports a load of 12 kN. The speed of the journal is 1800 rpm. The absolute viscosity of the oil is 0.01 pas at the operating temperature. Assume ratio of diameter to the diameteral clearance as 1000.

Determine the following : — 10

i) Sammer feld number

ii) The co-efficient of friction based on Mckee equation.

iii) Amount of heat generated.

8. A belt required to transmit 18.5 kW from pulley of 1.2 m diameter running at 250 rpm to another pulley which runs at 500 rpm. The distance between the centres of the pulley is 2.7 m. The following data refers to an open belt drive $\mu = 0.25$ safe working stress for the leather is 1.75 N/mm^2. Thickness of belt = 10 mm. Determine the width and length of belt taking centrifugal tension into account. Also find the initial tension of the belt and absolute power that can be transmitted by this belt. — 20

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