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P.E.S. College of Engineering, Mandya - 571 401
(An Autonomous Institution affiliated to VTU, Belgaum)
Sixth Semester, B.E. - Automobile 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 atleast **TWO** full questions from each **part**.*
    ii) *Assume missing data suitable, if any. Use of design data hand book is permitted.*
    iii) *Draw neat pencil sketches wherever necessary.*

PART - A

1. a. What are the assumptions made in the analysis of curved beam design?   5

   b. A ⊥ section frame for a punch press is shown in Fig. 1.1b. Determine the capacity of press if
       the maximum stress in the frame is not to exceed 60 N/mm^2.

Fig 1.1b.   15
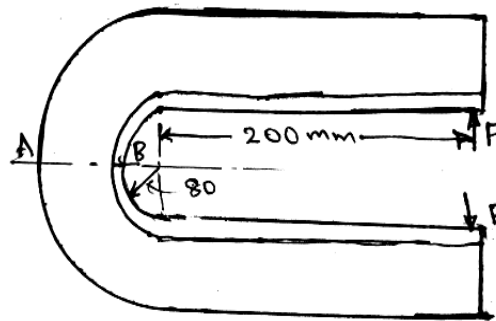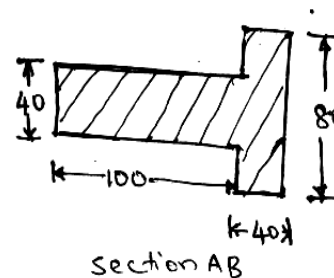
2 a. Distinguish between circumstantial stress and longitudinal stress in a cylindrical shell when
      subjected to an internal pressure.   5

  b. A shrink fit assembly, formed by shrinking one tube over another, is subjected to an internal
      pressure of 60 N/mm^2. Before the fluid is admitted, the internal and external diameters of the
      assembly are 120 mm and 200 mm and the diameter at the junction is 160 mm. If after
      shrinking on, the contact pressure at the junction is 8 N/mm^2, determine using Lame's
      equations, the stresses at the inner, mating and outer surfaces of the assembly after the fluid
      has been admitted.   15

3. a Write a brief note on types of spring.   6

   b. A helical compression spring is made of steel wire. It has an allowable shear stress of 600
       MPa the mean coil diameter of spring is 150 mm and a load of 4 kN is applied. Determine the
       size of wire.   4

c. A semi elliptical laminated spring made of 8 leaves is 1.1 m long between the centres of eyes. Two of the leaves extend full length of the spring. The beams arc held together by a band 80 mm wide. If the spring is to carry a load of 5.4 kN and the permissible stress for the spring material is not to exceed 400 MPa, find width and thickness of leaves when,   10

i) Leaves are not stressed initially   ii) Leaves are stressed initially

The deflection of spring is not to exceed 70 mm. The modulus of elasticity for spring material is 206.8 GPa.

4. a. A multiple disc clutch has radial width of friction material as $1/5^{th}$ of the maximum radius. The coefficient of friction is 0.25. Find the total number of discs required to transmit 60 kW at 3000 rpm. The maximum diameter of clutch is 250 mm and the axial force is limited to 600 N also find the mean unit pressure on each contact surface.   10

b. The block brake as shown in Fig. 4 b.(1) provides braking torque of 360 Nm. the diameter of the brake drum is 300 mm. The coefficient of friction is 0.3. Find,

i) The force P to be applied at the end of lever for the clockwise and counter clockwise rotation of drum.

ii) The location of pivot to make the brake self locking for the clockwise rotation of the brake drum.

Fig 4·b·1

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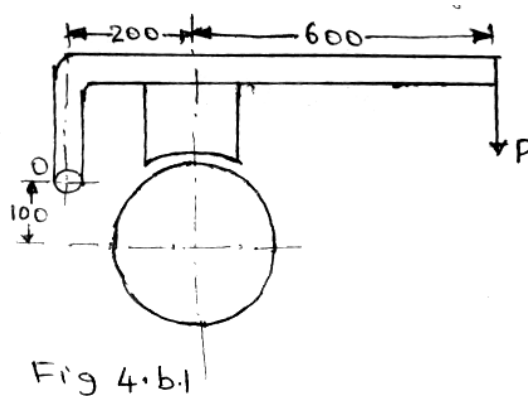
PART – B

5 a. How are the gears classified on what are the various terms used in spur gear terminology?   5

b. A spur gear made of bronze drives a mild steel pinion with an angular velocity ratio of 3.5 : 1. The pressure angle is $14\frac{1}{2}°$. It transmits 5 kW at 1800 rpm. Considering only strength, design the smallest diameter gears and also find necessary face width. The number of teeth should not be less than 15 on either gear. The elastic strength of bronze may be taken as 84 MPa and of steel as 105 MPa.   15

6 a. Explain the following terms used in helical gears.

(i) Helix angle   (ii) Normal Pitch   (ii) Axial Pitch.   6

b. A helical cast steel gear with 30º helix angle has to transmit 35 kW at 1500 rpm. If the gear has 24 teeth, determine the module, pitch diameter and face width for 20º full depth teeth. The static stress for cast steel = 56 MPa. The face width may be 3 times normal pitch. What would be the end thrust on gear?

14

7 A pair of straight tooth bevel gears at right angle is to transmit 5 kW at 1200 rpm of the pinion. The diameter of pinion is 80 mm and the velocity ratio is 3.5:1, The tooth form is 14½º full depth form. Both gears are made of cast iron with static stress 55 N/mm².
Design the gears and check for dynamic and wear load.

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8 a. What is meant by hydrodynamic lubrication? List the basic assumptions used in the theory of hydrodynamic lubrication.

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b. A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 rpm. The shaft turns in a bearing whose length is 1.5 times the shaft diameter. If the diametral clearance of the bearing is 0.15 mm and the absolute viscosity of the oil at the operating temperature is 0.011 kg/m-s. Find the power wasted in friction.

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c. Write a short note on classification and types of antifriction bearings.

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