USN | | | | | | | | | | |

10AU63

Sixth Semester B.E. Degree Examination, Aug./Sept.2020
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive an expression for normal stresses due to bending at the extreme fiber on the cross section of a curved beam member. **(08 Marks)**

b. Determine the safe load F that the frame of a punch as shown in Fig.Q.1(b) can carry considering the cross section along A-A for an allowable tensile stress of 100MPa what is stress at the outer fiber of the above load? What will be the stress at the inner fiber, if the beam is treated as the straight beam for the above load? **(12 Marks)**

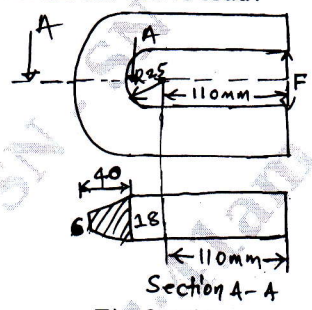


Fig.Q.1(b)

2 a. A cast iron cylindrical pipe of outside diameter 300mm and inside diameter 200mm is subjected on internal fluid pressure of $20N/mm^2$ and external fluid pressure of $5N/mm^2$. Determine the tangential stress and radial stresses at the inner, middle and outer surface and also sketch the tangential stress and radial stress distribution across its thickness. **(10 Marks)**

b. A solid shaft of 125mm diameter is to be pressed into a steel flange, which has an outside diameter of 150mm and length of 100mm. $E = 21 \times 10^4 N/mm^2$ $\gamma = 0.3$. Determine:
i) Proper size of bore so that the maximum stress in the bore does not exceed $160N/mm^2$
ii) Pressure between hub and shaft
iii) Force required to press the parts together
iv) Torque capacity of the press fit. **(10 Marks)**

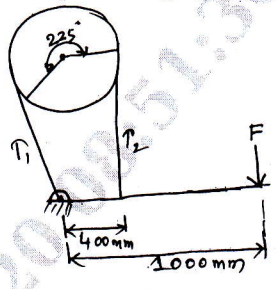
3 a. Derive an expression for stress induced in helical coil springs. **(06 Marks)**

b. A loaded narrow guage car weights 18kN and moving at a velocity of 80 meter/mints is brought to rest by a buffer consist of two helical springs. In bringing the car to rest the spring undergoes a compression of 200mm. The allowable shear stress is 0.3GPa and the spring index is 8. Design a suitable spring. Take G = 84GPa. **(14 Marks)**

4 a. Design a cone clutch to transmit a power of 40kW at a rated speed of 750rpm. (Assume Leather as a friction material). Determine:
i) Axial force necessary to transmit to torque.
ii) Axial force necessary to engage the cone clutch. **(10 Marks)**

b. A simple band break drum diameter 600mm has a band passing over it with an angle of contact 225° while one end is connected to fulcrum and other end connected to the break lever at a distance of 400mm from the fulcrum. The break lever is 1meter long. The break is to observed the power of 15kW at 720rpm. Design the break level of rectangular C/S. Assuming depth to be thrice the width. [Refer Fig.Q.4(b)] **(10 Marks)**

Fig.Q.4(b)



PART – B

5 a. Explain with sketch the formative number of teeth for helical gear. **(06 Marks)**

b. Two spur gears are to be used for a rock crusher drive and are to be of minimum size. The gears are to be designed for the following requirements: Power to be transmitted 18kW, speed of pinion 1200rev/min, velocity ratio 3.5 to 1, tooth profile 20° stub involute. Determine module and face width for strength requirements only. **(14 Marks)**

6 a. Explain with a neat sketch the formative number of teeth for Bevel gear. **(06 Marks)**

b. The following data refer to a worm and worm gear drive:

i) Center distance 200mm
ii) Pitch circle diameter of worm 80mm
iii) Number of start 4
iv) Axial module 8mm
v) Transmission ratio 20
vi) The worm gear is made of phosphor Bronze with allowable bending stress 55MPa
vii) The worm Hardened and ground steel
viii) Tooth form is 20° full depth involute.

Determine:

i) The number of teeth on the worm gear
ii) Lead angle
iii) Face width of worm gear to transmit 15kW at 1750rpm of the worm based on the beam strength of worm gear. **(14 Marks)**

7 a. Derive an expression for lightly loaded bearing (Petroffs equation). **(08 Marks)**

b. A full journal bearing 90mm diameter and 150mm long as a radial load of 2MPa per unit projected area. Shaft speed is 500rpm. The bearing is operating with automobile SAE 20 oil at 50°C. The specific gravity of oil at operating temperature is 0.985 calculate the following:

i) Minimum film thickness
ii) Heat loss due to friction
iii) Wheather artificial cooling is necessary. **(12 Marks)**

8 a. A flat belt is required to transmit 10kW from a pulley of 600mm effective diameter running at 300rpm. The angle of contact is spread over 7/16 of circumference. Determine the width of the belts whose thickness is 10mm the allowable stress for the belt is 2.25N/mm^2. Coefficient of friction between pulley and belts is 0.3. **(10 Marks)**

b. A 20mm 8 × 19 steel wire rope is used with a hoisting drum of 1 meter diameter to lift a load of 20kN. The depth of mine is 800M and the acceleration is 3m/sec^2. Determine the number of ropes required using factor of safety 5. Neglect the weight of skip. **(10 Marks)**

* * * * *