Sixth Semester B.E. Degree Examination, June/July 2015
Design of Machine Elements – II

Time: 3 hrs.   Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting*
atleast TWO questions from each part.
2. Design data hand book may be allowed.
3. Missing data, if any, may be suitably assumed.

PART – A

1   a. Find an expression for bending stresses produced in curved beam, subjected to a bending moment, M. Enumerate assumptions. **(10 Marks)**

   b. A curved beam of rectangular cross section of width 20 mm and depth 40 mm is subjected to a pure bending moment of 600 Nm. The mean radius of curvature is 50 mm. Determine location of neutral axis, maximum and minimum stress, ratio of maximum to minimum stress. **(10 Marks)**

2   a. Why there is a need to compound cylinders. **(05 Marks)**

   b. A compound cylinder is made by shrinking a cylinder of external diameter 300 mm and internal diameter of 250 mm over another cylinder of external diameter 250 mm and internal diameter 200 mm. The radial pressure at the junction after shrinking is 8 MPa. Find the final stresses set up across the section. when compound cylinder is subjected to an internal fluid pressure of 84.5 MPa. **(15 Marks)**

3   a. Write a note on materials for springs. **(05 Marks)**

   b. A helical spring is made of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2, find the axial load which the spring can carry and deflection per active turn by i) neglecting the curvatures effect ii) considering the curvatures effect. **(15 Marks)**

4   A spur gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1 : 2 and rpm of the pinion is 200. The approximate center distance between the shafts may be taken as 600 mm. The teeth has 20° stub involutes profiles. The static stress for both gear materials (cast iron) may be taken as 60 MPa and face width is 10 times module. Find the module, face width and number of teeth on each gear. Chick the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham's equation may be taken as 80 and material combination factor for wear as 1.4. **(20 Marks)**

PART – B

5   A pair of bevel gears is required to transmit 10 kW power at 500 rpm from a motor shaft to a machine shaft. The speed reduction is 3 : 1 and the shafts are inclined at 60°. The pinion is to have 24 teeth pressure angle 20° and is to be made of cast steel having strength of 75 N/mm^2. The gear is to be made of CI with static stress of 55 N/mm^2. The pinion is mounted midway on the shaft which is supported between bearings having span of 200 mm. Design gear pair. **(20 Marks)**

6 a. Determine the maximum, minimum and average pressure in a plate clutch when an axial force of 4000 N is acting. The inside radius of contact surface is 50 mm and outside radius is 100 mm. Assume uniform wear theory.   (10 Marks)
   b. Write the design consideration of brakes.   (04 Marks)
   c. What is a self energizing brake? When a brake becomes self locking.   (06 Marks)

7 a. Discuss types of lubricants and their properties.   (08 Marks)
   b. The load on the journal bearing is 150 kN due to turbine shaft of 300 mm diameter running at 1800 rpm. Determine the following :
      i) length of bearing if the allowable bearing pressure is 1.6 N/mm^2
      ii) amount of heat to be dissipated by the lubricant per minute if the bearing temperature is 60°C and viscosity of oil at this temperature is 0.02 kg/ms and the bearing clearance is 0.25 mm.   (12 Marks)

8 Two shafts whose centers 1 m apart are connected by a v-belt drive. The driving pulley is supplied with 95 kW power and has an effective diameter of 300 mm. It runs at 1000 rpm. While the driven pulley runs at 375 rpm. The angle of groove on the pulleys is 40° permissible tension in 400 mm^2 cross-sectional area belt is 2.1 MPa. The material of the belt has density of 1100 kg/m^3. The driven pulley is overhung, the distance of the center from the nearest bearing being 200 mm. The coefficient friction between belt and pulley rim is 0.28. Estimate :
   i) the number of belts required and
   ii) diameter of driven pulley shaft, if permissible shear stress is 42 MPa.   (20 Marks)

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