Sixth Semester B.E. Degree Examination, June/July 2013
Design of Machine Elements – II

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer FIVE full questions, selecting*
at least TWO questions from each part.
2. *Use of design data hand book is permitted.*

PART – A

1. a. The cross section of a steel crane hook is a trapezium with an inner side of 50 mm and outer side of 25 mm. The depth of the section is 64 mm. The centre of curvature of the section is at a distance of 64 mm from the inner edge of the section and the line of action of load is 50 mm from the same edge. Determine the maximum load hook can carry if the allowable strength is limited to 60 MPa. **(10 Marks)**

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

2. a. Select a V-belt drive to transmit 10 kW power from a pulley of 200 mm diameter mounted on an electric motor running at 720 rpm to another pulley mounted on compressor running at 200 rpm. The service is heavy duty varying from 10 hrs to 14 hrs per day and distance between centre of pulley is 600 mm. **(10 Marks)**

   b. A roller chain is to transmit 66.24 kW from a 17 tooth sprocket to a 34 tooth sprocket at a pinion speed of 300 rpm. The loads are moderate shock. The equipment is to run 18 hrs/day. Specify the length and size of the chain required for a centre distance of about 25 pitches. **(10 Marks)**

3. a. The laminated leaf spring has an overall length of 1.1 m and has a central load of 160 kN. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100 mm wide. All the leaves are to be stressed to 400 N/mm^2, when fulley loaded. The ratio of total spring depth to width is approximately 2. Determine
      i) The width and thickness of the leaves.
      ii) Initial space must be provided between full length and graduated leaves.
      iii) What load is exerted on the band when the leaves are assembled? **(10 Marks)**

   b. Design a value spring for an automobile engine, when the valve is closed, the spring produces a force of 45 N and when it opens produces a force of 55 N. The spring must fit over the valve bush which has an outside diameter of 20 mm and must go inside a space of 35 mm. The lift of the valve is 6 mm. The spring index is 12. The allowable stress may be taken as 0.33 GPa. Modulus of rigidity 80 GPa. **(10 Marks)**

4. It is required to transmit 15 KW power from a shaft running at 1200 rpm to a parallel shaft with speed reduction of 3. The centre distance of shafts is to be 300 mm. The material used for pinion is steel (σ_d = 200 MPa) and for gear is CI (σ_d = 140 MPa). Service factor is 1.25 and tooth profile is 20° full depth involute. Design the spur gear and check the design for dynamic and wear. **(20 Marks)**

PART – B

5 Complete the design and determine the input capacity of worm gear speed reducer unit which consists of hardened steel worm and phosphor bronze gear having 20° stub involute teeth. The centre distance is to be 200 mm and transmission ratio is 10, speed of the worm is 2000 rpm. **(20 Marks)**

6 a. A multiplate clutch has steel on bronze is to transmit 8 kW at 1440 rev/min. The inner diameter of the contact is 80 mm and the outer diameter of contact is 140 mm. The clutch operates in oil with expected co-efficient of friction of 0.1. The average allowable pressure is 0.35 MPa. Assume uniform wear theory and determine the following:
   i) Number of steel and bronze plates.
   ii) Axial force required.
   iii) Actual maximum pressure. **(10 Marks)**

   b. A simple band brake of drum diameter 600 mm has a band passing over it with an angle of contact of 225°, 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 1 m 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 80 MPa. **(10 Marks)**

7 a. Derive Petroff's equation for coefficient of friction in journal bearings. **(08 Marks)**

   b. The main bearing of a steam turbine runs at 1500 rpm and has a diameter of 40 mm. The load on a bearing is estimated to be 3 kN. Assume clearance ratio of 0.001 mm, length to diameter ratio is 1.5 and well ventilated. The operating temperature of the oil fill is 60°C and oil used is turbine oil SAE10. Determine wether,
   i) Fluid film lubrication can be expected.
   ii) Is artificial cooling is necessary.
   iii) The amount of oil flow. **(12 Marks)**

8 Design a cast iron piston for a single acting four-stroke diesel engine with the following data:
cylinder bore = 200 mm, length of stroke = 250 mm, speed = 600 rpm, brake mean effective pressure = 0.60 MPa, maximum gas pressure = 4 MPa, fuel consumption = 0.25 kg per BP per hour. μd ratio for bush in small end of connecting rod = 1.5. **(20 Marks)**

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