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10ME62

Sixth Semester B.E. Degree Examination, June/July 2017
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 handbook is permitted.
3. Missing data, if any, may be suitably assumed.

PART – A

1 a. Give the differences between a straight and curved beam. **(04 Marks)**

b. Compute the combined stresses at the inner and outer fibres in the critical cross section of a crane hook which is required to lift load upto 25 kN. The hook has trapezoidal cross section with parallel sides 60mm and 30mm, the distance between them being 90mm. The inner radius of the hook is 100mm. The load line is nearer to the inner surface of the hook by 25mm than the centre of curvature at the critical section. What will be the stresses at inner and outer fibre, if the beam is treated as straight beam for the given load? **(16 Marks)**

2 a. Two shafts 1meter apart are connected by a v-belt to transmit 90 KW at 1200 rpm of a driver pulley of 300mm effective diameter. The driven pulley rotates at 400 rpm. The angle of groove is 40° and the coefficient of friction between the belt and the pulley rim 0.25. The area of the belt section is 400mm^2 and the permissible stress is 2.1 MPa. Density of the belt material is 1100 kg/m^3. Calculate the number of belts required and the length of the belt. **(10 Marks)**

b. Select a wire rope for a vertical mine hoist to lift a load of 55kN from a depth of 300 meters. A rope speed of 500m/min is to be attained in 10 seconds. **(10 Marks)**

3 a. Design a helical spring used in a recoil system so as to absorb 120 Nm of energy with a maximum force of 3000N. Assume spring index 8 and factor of safety is 2. **(10 Marks)**

b. A multi leaf spring with camber is fitted to the chassis of an automobile over a span of 1.2m to absorb shocks due to a max load of 20 kN. The spring material can sustain a max. Stress of 0.4 GPa. All the leaves of the spring were to receive the same stress. The spring is required at least 2 full length leaves out of 8 leaves. The leaves were assembled with bolts over a span of 150mm width at the middle. Design the spring for a max. deflection of 50mm. **(10 Marks)**

4 Design a pair of spur gears to transmit a power of 18 kW from a shaft running at 1000rpm to a parallel shaft to be run at 250 rpm maintaining a distance of 160mm between the shaft centers. Suggest suitable surface hardness for the gear pair. **(20 Marks)**

PART – B

5 Design a pair of bevel gears to transmit a power of 25 kW from a shaft rotating at 1200 rpm to a perpendicular shaft to be rotated at 400rpm. **(20 Marks)**

6 a. Determine the dimensions of a simple cone clutch to transmit 20 KW at 1000 rpm. The minimum diameter is to be 300mm and the cone angle 20°. Assume $\mu = 0.2$ and permissible pressure = 0.1 N/mm^2. Also determine the axial force required to engage the clutch. **(10 Marks)**

b. A simple band broke of drum diameter 600mm 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 400mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb a power of 15 KW at 720rpm. Design the brake lever of rectangular cross-section, assuming depth to the thrice the width. Take allowable stress 80 MPa. **(10 Marks)**

7 a. Derive Petroff's equation for co-efficient of friction for hydro dynamic bearing. **(08 Marks)**

b. Design a journal bearing for a centrifugal pump running at 1200rpm. Diameter of journal is 100mm and load on bearing is 15 kN. Take L/d = 1.5, bearing temperature 50°C and ambient temperature 30°C. Find whether artificial cooling is required. **(12 Marks)**

8 Design a suitable aluminium alloy piston with two compression rings and one oil ring for a petrol engine of following particular :

Cylinder diameter	= 0.10m
Peak gas pressure	= 3.2MPa
Mean effective pressure	= 0.8 MPa
Average side thrust	= 2400N
Skirt bearing pressure	= 0.22MPa
Bending stress in piston crown	= 36MPa
Crown temperature difference	= 70°C
Heat dissipated through crown	= 157 kJ/m^2 s
Allowable radial pressure	= 0.04MPa
Binding piston in rings	= 90MPa
Heat conductivity K	= 160 W/m/°C

Assume any further data required for the design. **(20 Marks)**

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