Code :R7320305 1

III B.Tech II Semester(R07) Regular & Supplementary Examinations, April/May 2011
DESIGN OF MACHINE MEMBERS-II
(Mechanical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE questions
All questions carry equal marks

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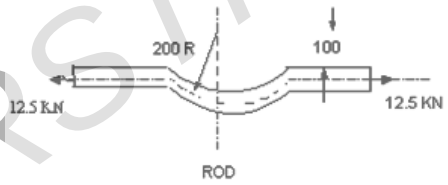
1. (a) Differentiate between Hydrostatic and Hydrodynamic bearings.
   (b) A full journal bearing of 100 mm diameter and 150 mm long, supports a radial load of 6 KN. The shaft rotates at 600 r.p.m. The radial clearance is 0.08 mm. The room temperature is 25^0C, and the temperature of the bearing surface is limited to 55^0C. The bearing is well ventilated and so no artificial cooling is required. Suggest suitable oil to meet the requirements.

2. (a) Derive an equation for the Whipping stress in the connecting rod.
   (b) Explain the design procedure for Big end of the connecting rod.

3. (a) How do you reduce the distortion of the liners?
   (b) What is the use of surface treatment of cylinder liners? Describe the various methods.

4. It is necessary to bend a link as shown in figure- in order to prevent interference with another part of the machine. The link is to suppose a load of 12.5 KN with a design factor of 2.5 on the yield strength of 250 MPa. Determine the thickness of the rectangular cross section of the link if the depth is to be 50 mm, neglecting stress concentration due to curvature and then find the increase in stress in this section when curvature is taken into account.



5. Find the width of the belt necessary to transmit 10kW to a pulley 250mm diameter, if the pulley makes 1500 r.p.m. and the coefficient of friction between the belt and the pulley is 0.22. Assume the angle of contact as 210^0 and the maximum tension in the belt is not to exceed 8N/mm width.

6. The maximum thrust on a drill spindle is 15 kN. A 18 teeth pinion, driving a rack fitted on the spindle is used to feed the drill into the work. Determine the module for the steel pinion. Take face width as 40 mm, and tooth profile as 14 1/2 ^{0} full depth involute.

7. What advantages do the ball screws have over the usual translational screws? And What are the disadvantages? List applications for the recirculating the ball type of screw.

8. A 2m long, 1m high and 0.5 m wide lathe bed consists of two vertical walls strengthened by perpendicular or diagonal stiffeners. The thickness of the walls is 50mm, while that of the stiffners is 25mm. calculate the reduced bending rigidity of the beds having perpendicular and diagonal stiffeners.

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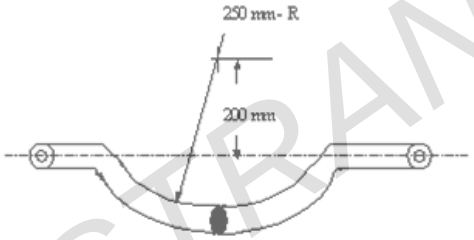
1. (a) What are the different types of lubricants used in practice?
   (b) Layout the design procedure for Hydrodynamic journal bearing.
2. Explain the step-by-step design procedure for connecting rod of an I.C engine.
3. Determine the wall thickness of a 225 mm gas engine cylinder made of nickel cast iron. The maximum gas pressure is 2.2 Mpa. Also determine the thickness of the cylinder head and the number and size of the hold down bolts for the cylinder.
4. An offset tensile link is shaped to clear an obstruction with geometry as shown in the figure. The cross section at the critical location is elliptical, with a major axis of 100 mm and a minor axis of 50 mm. For a load of 90 KN, estimate the stresses at the inner and outer surfaces of the critical section.



5. A V belt dive system transmits 90kW at 475 r.p.m. the belt has a mass of 0.6kg/m. the maximum permissible tension in the belt is 900N. The groove angle is 38^0 and the angle of contact is 160^0 find the minimum number of belts and pulley diameter. The coefficient of friction between belt and pulley is 0.2.
6. A reciprocating compressor is to be connected to an electric motor, through spur gearing. The distance between the shafts is 360 mm. The speed of the electric motor is 1000r.p.m.and the speed of the compressor shaft is 200 r.p.m. The torque to be resisted by the motor shaft is 3600 N-m. Determine (i) module and face width of the gears, using 20^0 stub teeth and (ii) number of teeth and pitch circle diameter of each gear.
7. (a) Differentiate between differential screw and compound screw.
   (b) Discuss the effect of efficiency in power screw applications. List some examples where a high efficiency is desirable. Also list applications where a lower efficiency might be needed.
8. A hollow rectangular steel base of height 200mm, width 1000mm and wall thickness 25mm is loaded as shown in figure-5. Calculate the maximum angle of slope.

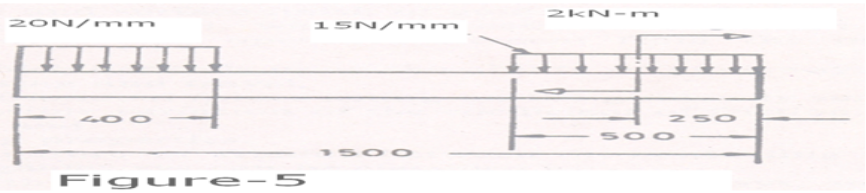


Figure-5

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1. (a) Name the commonly used bearing materials with their properties and limitations for sliding contact bearings.
   (b) Explain the design procedure for bearing cap and its holding down bots.
2. (a) What are the commonly used materials for the connecting rods?
   (b) The connecting rod of a slow speed Diesel engine is 3 m long and is made of alloy steel 55. Determine the suitable dimensions for a circular section of the rod. The bore and stroke of the cylinder are 900 mm and 1200 mm respectively. The maximum combustion pressure is 4.8 MPa.
3. Design the cylinder liner for a four-stroke water-cooled vertical diesel engine developing 4.476 KW power and running at 600 rpm. Assume the missing data reasonably.
4. Design a hook and its support for a 20 KN crane. The hook is of swiveling type and of trapezoidal section having a bed diameter of 80mm. The side members and the bridge are of forged steel. Design the hook for 50% overload. Assume suitable allowable stresses and draw a detailed drawing of the hook.
5. Determine the percentage increase in power capacity made possible in changing over from flat belt drive to a V-belt drive. The diameter of the flat pulley is same as the pitch diameter of the grooved pulley. The pulley rotates at the same speed as the grooved pulley. The coefficient of friction for the grooved and flat belt is same and is 0.3. The V- belt pulley groove angle is 60^0. The belts are of the same material and have same cross sectional area. In each case, the angle of wrap is 150^0.
6. A cast steel 24 teeth spur pinion, operating at 1200 r.p.m, transmits 3 kW to a cast steel 56 teeth spur gear. The other particulars of the drive are: Module, m = 3 mm, Static strength = 100 MPa, Face width = 35 mm, Tooth profile = 14 1/2 ^{0} full depth involute,
   Determine (i) induced stress in the weaker gear, (ii) dynamic load, (iii) wear load and (iv) allowable static load.
7. (a) Give examples of the use of buttress threads for the translation screws.
   (b) List-out the different types of stresses, to which a screwed fastener is generally subjected.
8. A hollow rectangular table is 2m long, 60cm wide and 9cm high. The 15mm thick horizontal walls of the table are joined by 10mm thick vertical stiffeners spaced at 400mm. Calculate the reduced stiffness of the table.

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1. (a) How the sliding contact bearings are classified?
   (b) A ship traveling at 35 Kmph requires 2500 KW at the propeller. The diameter of the propeller shaft is 250 mm. Determine the number of collars required and collar thickness, if the bearing pressure is not to exceed 0.35 N/mm^2. The outer diameter of the thrust collar may be taken as 1.6 times the propeller shaft diameter. Also determine the heat developed at the bearing.

2. The high speed diesel engine has the following particulars: Bore of the cylinder 90 mm, stroke140 mm, speed 1500 rpm, compression ratio 16, maximum pressure 5.4 MPa up to 7% of the stroke, mass of the reciprocating parts is 3 kg, and the length of the connecting rod 350 mm.
   Design a suitable connecting rod for the given duty.

3. (a) List the various Liner materials.
   (b) How a piston is cooled and what are the advantages of cooling?
   (c) How will you fix the size of the piston rings?

4. Design a hook and its support along with a thrust bearing for a 5 KN load. The hook is of swiveling type and of triangular section. Choose your own materials and the probable values of permissible stresses, design and draw a detailed drawing of the hook for 50% overload.

5. Select a V- belt drive for 7 kW power to be transmitted from one shaft running at 1750 r.p.m. to other shaft at around 1200 r.p.m. The service factor may be taken as 1.3. The centre distance must not greater than 1.2m. Take larger pulley diameter as 300mm.

6. A pair of 5 mm module, 20^0 involute full depth spur gears, with a face width of 40 mm are made of steel having 350 BHN. The pinion has 28 teeth and runs at 1200 rp.m. The gear ratio is 4. What power can be transmitted as per Lewis strength design? Assuming that this much power is being transmitted, check the design for dynamic and wear loads. The static strength of the material of the gears is 210 MPa, and surface endurance limit is nearly 900 MPa.

7. The lead screw of a lathe has square threads of 24mm outside diameter and 5mm pitch. In order to drive the tool carriage, the screw exerts an axial pressure of 2.5 kN. Find the efficiency of the screw and the power required to drive the screw, to rotate at 30 r.p.m. Neglect bearing friction. Assume coefficient of friction of screw threads as 0.12.

8. A steel structure is studied by making its Perspex model on 1:10 scale. The natural frequency of the model in bending was found to be 150Hz. Determine the natural frequency of the steel structure, if density of Perspex =1.2g/m^3.

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