

Design of Machine Elements

P. Pages : 2

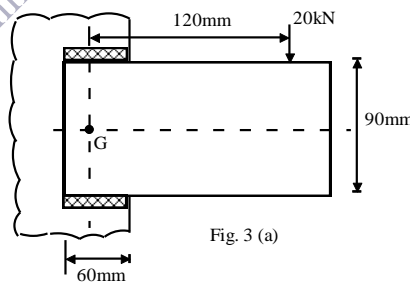
Time : Three Hours

**KNT/KW/16/7339/7366**

Max. Marks : 80

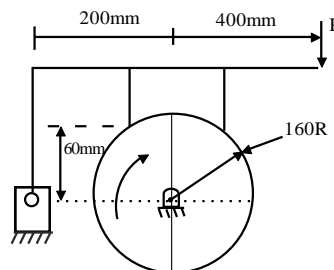
- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Assume suitable data whenever necessary.
 7. Illustrate your answers whenever necessary with the help of neat sketches.
 8. Use of non programmable calculator is permitted.
 9. Design data book is permitted.

1. a) Explain in brief the tentative design procedure. **5**
 b) Enumerate the factors and properties of a material a designer is required to consider while designing a pressure cooker. **5**
 c) Two lengths of a steel tie rod having width of 200mm and thickness of 12 mm are to be connected by means of a butt joint with double cover strap. Design a uniform strength joint for this connection. Select wrought iron for rivets & plate is made of SAE1020. **10**
2. a) Design a Knuckle joint to carry a tensile load of 50kN. The rod and pin are made of SAE 1030 steel. Assume a factor of safety of 2. **12**
 b) Explain in brief the various types of failure with reference to types of loading condition i.e. static & varying dynamic loading **8**
3. a) A bracket carrying a load of 20 kN is to be welded as shown in fig. 3(a). Find the size of weld required if the allowable shear stress is not to exceed 90 MPa. **10**



- b) Two rod ends of a pump are joined by means of a cotter joint. Design the joint for an axial load of 50kN, which changes alternately from tension to compression. All the point are made of SAE 1020 steel. Assume factor of safety of 2. **10**
4. a) A pressure vessel made of SAE 1020 steel having internal diameter of 240 mm is subjected to an internal pressure of 3 MPa. The top cover plate is flat circular and bolted. And the Bottom cover plate is hemispherical and integral welded. Determine. **15**
 - i) Thickness of shell.
 - ii) Size and number of bolt required for top cover plate.
 - iii) Thickness of bottom cover plate.
 - iv) Gasket material and it's size for leakproof joint.
 - v) Thickness of top cover plate.

- b) Explain the different types of levers with sketch along with practical application of each type. **5**
5. a) A 650mm pulley driven by a horizontal belt transmits power through a solid steel shaft to a 240 mm pinion which drives a mating gear located below. The pulley weighs 1.1 kN to provide some flywheel effect. The shaft is supported in two bearings located 900mm apart. The pulley is located at 300 mm to the right of the left hand bearing and the gear is located at 200 mm to the right of right hand bearing. The belt tensions are 5.4kN and 1.6kN. The gear has 20° full depth involute teeth. Determine the necessary shaft diameter as per A. S. M. E. code for $k_b = 2$ and $k_t = 1.5$ the shaft is made of SAE 1030 steel. **16**
- b) Design the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key material are 63MPa and 100 MPa respectively. **4**
6. a) A loaded car weighing 20kN and moving at a velocity of 75 m/min is brought to rest by a bumper consisting of two helical steel springs. In bringing the car to rest, the spring are to be compressed by 200mm. Assuming the spring index of 6 and the allowable stress of 350MPa, determine
- Maximum load on each spring
 - Diameter of wire
 - Mean diameter of coil
 - Number of effective coil.
- b) A semi elliptic car leaf spring has a length of 1 meter and carries a load of 45 kN. It is made up of 18 leaves, 75 mm wide, three of which are full length leaves. Spring is made of SAE 6150 steel with a safety factor of 2.25. Suggest suitable thickness for the leaves and calculate the resulting deflection when
- The Extra full length leaves are pre-stressed.
 - There is no prestress in the extra full length leaves.
7. a) Design a multiple disc clutch to transmit 11 kw at 960 RPM. The mean diameter of disc should be 160mm. The discs are made of steel and bronze and the clutch operator in oil. What will be the average pressure and the maximum pressure on the disc; for uniform wear theory Assume $D_i/D_o = 0.67$. **10**
- b) A single blocks brake with torque capacity of 20N-m is shown in fig. 7(b) Consider coeff. of friction. 0.3, maximum pressure on brake lining 1N/mm² & width of block equal to its length find
- Actuating force
 - Dimensions of block
 - Resultant hinge-pin reaction



8. a) A screw jack is to lift a load of 200 kN through a height of 150mm. The screw is made of SAE 1020 steel. And the nut is made of cast iron high grade 35. The bearing pressure between nut and screw is not to exceed 15 MPa. Take factor of safety of 2. Design the screw and nut. **14**
- b) Discuss various types of power screw thread profiles, Give at least two practical application for each type. **6**
