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JOHN COX MEMORIAL CSI INSTITUTE OF TECHNOLOGY
TRIVANDRUM-11
KANNAMMOOLA

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, April 2014
(2008 Scheme)
Branch : Mechanical Engg.
08.605 : DESIGN OF MACHINE ELEMENTS – I

Time : 3 Hours Max. Marks : 100

Instructions : *1) Approved design data hand book **permitted**.*
*2) **Assume** missing data, if **any** suitably.*
*3) Answer **all** questions from Part **A** and **one** full question from **each** Module, from Part **B**.*

PART – A

1. Calculate the maximum clearance and minimum interference and also mention the limits of the size for the hole and shaft for easy keying of coupling in the shaft for 50 H7k6.
2. Define notch sensitivity index.
3. Explain the theories of failure which are commonly used for brittle materials.
4. Discuss the various types of keys with suitable sketches.
5. What are the advantages of preloading of bolts in a bolted joint ?
6. Explain flexible coupling with their applications.
7. Explain Wahl stress concentration factor.
8. Define equivalent twisting moment and equivalent bending moment.
9. Explain dilation of pressure vessels.
10. Explain surge in springs. **(10×4=40 Marks)**

P.T.O.

PART – B

Module – I

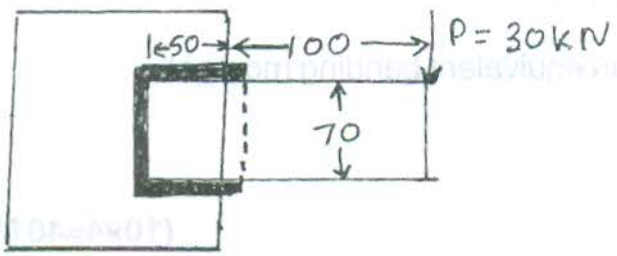
11. A pulley is keyed to a shaft midway between two anti-friction bearings. The bending moment at the pulley varies from – 190 Nm to 530 Nm as the torsional moment in the shaft varies from 60 Nm to 170 Nm. The frequency of the variation of the loads is the same as the shaft speed. The shaft is made of cold drawn steel having an ultimate strength of 545 MPa and a yield strength of 400 MPa. Determine the required diameter for an indefinite life. The stress concentration factor for the keyway in bending and torsion may be taken as 1.65 and 1.38 respectively. Assume design factor as 1.6.

12. A stepped shaft with the reduction ratio of 1.2 is to have a fillet radius of 10% of the smaller diameter. The material of the shaft has notch sensitivity factor of 0.9, a shear stress of 155 MPa at yield and a shear stress of 115 MPa at endurance limit. Determine the diameter of the shaft at the minimum cross section to sustain a twisting moment that fluctuates between 550 Nm to –850 Nm. Assume factor of safety as 2.

Module – II

13. A load of 600 kN is to be raised and lowered by means of two square threaded screws. If the coefficient of friction between the screw and nut is 0.048, determine the size of screw and nut. Compressive stress in screw is 80 MPa. Bearing pressure is 15 MPa. Find also the torque required to raise and lower the load.

14. A bracket supporting a load P = 30 kN is welded to a vertical member by four fillet welds as shown in figure. Calculate the size of the weld if the shear stress in the throat section is not to exceed 85 N/mm^2.



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Module – III

15. a) The piston rod of a hydraulic cylinder exerts an operating force of 10 kN. The friction due to piston packings and stuffing box is equivalent to 12% of operating force. The pressure in the cylinder is 10 MPa. The cylinder is made of cast iron with ultimate stress of 210 MPa and factor of safety 4.5. Determine the diameter and thickness of the cylinder. **7**

b) A semi elliptical laminated, automobile spring to carry a load of 3 kN is to consist of seven leaves 58 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1080 mm in length and is to be attached to the axle by two U bolts 80 mm apart. These bolts clamp the central portion of the spring so rigidly that they may be considered equivalent to a band having width equal to the distance between the bolts. The leaves are to be made of silica-manganese steel. Assuming an allowable stress of 350 N/mm^2, determine thickness for leaves and deflection. **13**

16. A shaft is supported by two bearings placed 1 m apart. A 650 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.5 kN. Another pulley 450 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 70 N/mm^2 in tension and 45 N/mm^2 in shear for the material of the shaft. Assume that the torque on one pulley is equal to that on the other pulley.

(3×20=60 Marks)