Reg. No: ……
Name : …….

SIXTH SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

Branch: Mechanical Engineering

13.605. DESIGN OF MACHINE ELEMENTS-I (M)

Time: 3 Hours Max. Marks: 100

Part A

*(Answer **all** questions; each carries **4** marks)*

1. What are the factors that affect endurance limit of a machine part?
2. State maximum shear stress and maximum strain energy theory of failure.
3. Enumerate different types of keys. Derive the relation for the strength of a key.
4. With neat sketch, explain caulking and fullering.
5. Explain surge in springs. How this can be avoided?

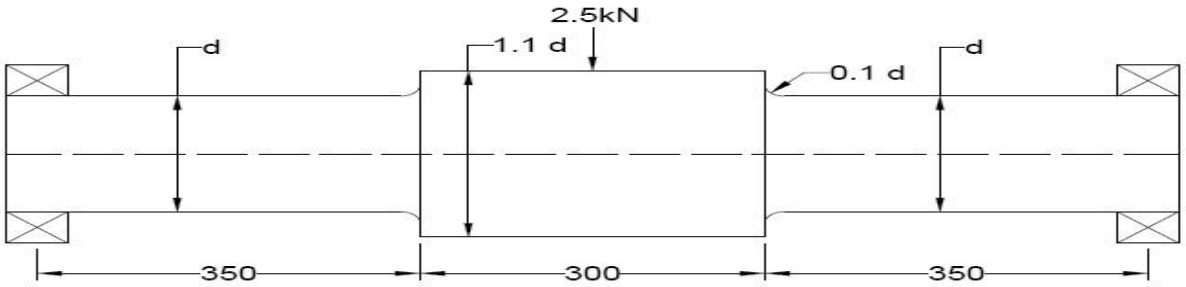
(5 X 4 = 20 Marks)

Part B

*(Answer any **ONE** question from each Module; each carries **20** marks)*

Module - I

6. A non rotating shaft supporting a load of 2.5 kN as shown in figure. The shaft is made of brittle material, with an ultimate tensile strength of 300 N/mm2. The factor of safety is 3. Determine the dimensions of the shaft.



7. A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by; ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa.

Module - II

8. A machine shaft, supported on bearings having their centers 750 mm apart, transmitted 185kW at 600 r.p.m. A gear of 200mm and 200 tooth profile is located 250 mm to the right of left hand bearing and a 450 mm diameter pulley is mounted at 200 mm to right hand bearing. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 1800 angle of contact. The pulley weighs 1000N and tension ratio is 3. Find the diameter of the shaft, if the allowable shear stress of the material is 60 MPa.
9. Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 20% greater than the full load torque. The shear stress for cast iron is 14 MPa.

Module - III

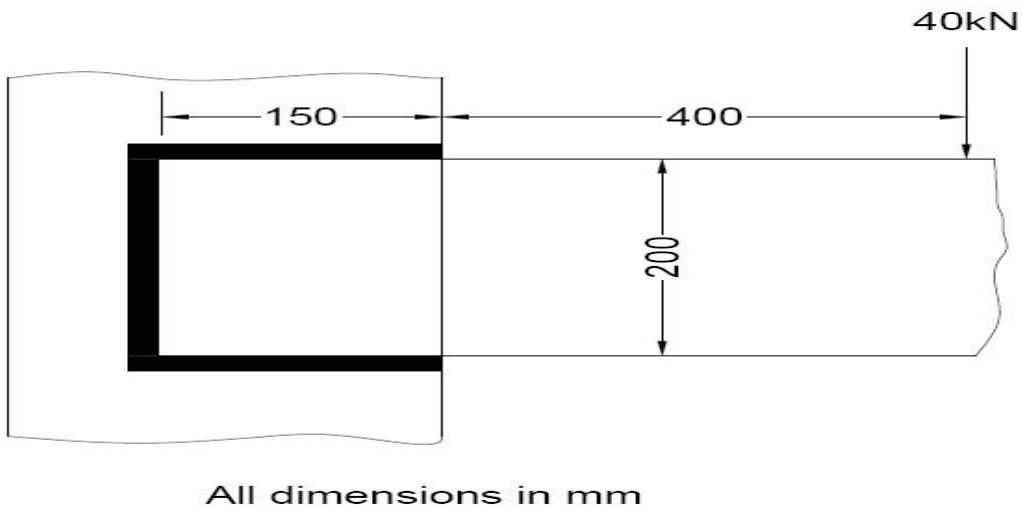
10. Two flat plates subjected to a tensile force P are connected together by means of double riveted double strap zig-zag pattern. The force P is 250kN and the width of the plate is 200mm. The rivets and plates are made of the same steel and the permissible stresses in tension, compression and shear are 70 N/mm2, 100 N/mm2 and 60 N/mm2 respectively. Calculate:

    a) The diameter of the rivets;

    b)The thickness of the plates;

    c) The efficiency of the joint.

11. A bracket as shown in figure carries a load of 40kN. Calculate the size of weld, if the allowable shear stress is not exceed 80 MPa



Module - IV

12. Design a helical spring for a spring loaded safety valve for the following conditions:

Operating pressure	= 1 N/mm2
Maximum pressure when the valve blows off freely	= 1.075 N/mm2
Maximum lift of the valve when the pressure is 1.075 N/mm2	= 6 mm
Diameter of valve seat	= 100 mm
Maximum shear stress	= 400 MPa
Modulus of rigidity	= 86 kN/mm2
Spring index	= 5.5

13. A semi-elliptical laminated spring 900mm long 55 mm wide is held together at the centre by a band 50mm wide. If the thickness of each leaf is 5 mm, find the number of leafs required to carry a load of 4500 N. assume a maximum working stress of 490 MPa.