

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-521**  
**FACULTY OF SCIENCE & TECHNOLOGY**  
**T.E. (Mechanical) (CGPA) (Sem-I)**  
**Design of Machine Elements - I**  
**[Revised]**

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

- N.B.: i) Q. No.1 and 6 are compulsory.  
 ii) Solve any two questions from remaining in each section.  
 iii) Assume suitable data if necessary.

**Section – A**

- Q.1 Solve any five 10
- Enlist the steps involved in design of machine element.
  - Explain Factor of safety.
  - Explain the following  
 $26Cr_4MO_2$ , FeE400
  - State maximum shear stress theory of Failure.
  - Define lever? What are its types
  - Give applications of cotter joint and knuckle joint.
- Q.2 A mild steel bracket as shown in fig.1 is subjected to a pull of 6000N acting at  $45^\circ$  to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross-sectional dimensions of the bracket, if permissible stress in the material of the bracket is limited to 60 MPa. 15

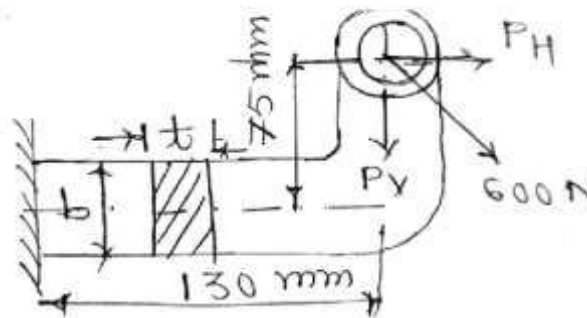
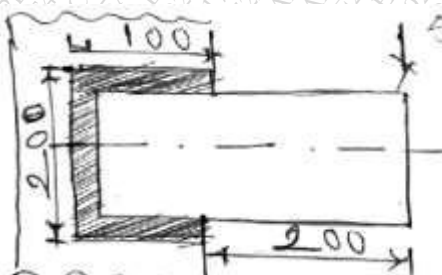


Fig.1

- Q.3 Design a socket and spigot joint used to connect two co axial shafts subjected to a tensile Force of 25KN. The material to be selected for joint is 30C8 ( $S_{yt}=400\text{MPa}$ ). Draw neat sketch and specify major Dimensions. 15
- Q.4 Explain with neat sketch, design procedure for rigid flange coupling. 15
- Q.5 The cutter of a broaching machine is pulled by a square threaded screw of 55mm external diameter and 10 mm pitch. The operating nut takes the axial load of 400N on a Flat surface of 60 mm and 90 mm internal and external diameters respectively. If the coefficient of Friction is 0.15 for all contact surfaces on the nut. Determine the power required to rotate the operating nut when the cutting speed is 6 m/min. Also find the efficiency of the screw. 15

## Section – B

- Q.6 Solve any Five 10
- Difference between Failure due to static load and Fatigue Failure.
  - Explain Notch Sensitivity Factor.
  - Draw the sketch – Transverse Fillet parallel Fillet
  - Enlist types of Failure in riveted joint
  - Draw neat sketch – Multi leaf spring.
  - Explain – solid length, Free length for Helical coil spring.
- Q.7 A simply supported beam has a concentrated load at the centre which fluctuates from a value of  $P$  to  $4P$ . The span of the beam is 500 mm and its cross section is circular with diameter of 60mm. Taking for the beam material stress of 700 MPa, a yield stress of 500 MPa. Endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, Calculate the maximum value of  $P$ . Take a size factor of 0.85 and a surface finish factor of 0.9. 15
- Q.8 A welded connection of steel plate as shown in fig.2. It is subjected to an eccentric Force of 50 KN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed  $70 \text{ N/mm}^2$ . 15
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- Q.9 Design a close coiled helical compression spring for a service load ranging from 2250N to 2750N. The axial deflection of spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity  $G=84 \text{ KN/mm}^2$ . Also draw a fully dimensioned sketch of the spring. 15
- Q.10 A helical compression spring of the exhaust valve mechanism is initially compressed with a pre-load of 375N. When spring is further compressed and the valve is fully opened, the torsional shear stress in the spring wire should not exceed  $750 \text{ N/mm}^2$ . Due to space limitations, the outer diameter of the spring should not exceed 42 mm. The spring is to be designed for minimum weight. Calculate the wire diameter and mean coil diameter of spring. 15