

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-III Examination December 2009****Subject Code: 131902****Subject Name: Machine Design & Industrial Drafting****Date: 21 / 12 / 2009****Time: 11.00 am – 2.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) 1. Explain hole-based and shaft based limit system with neat sketch **04**
 2. Define limits, fits & upper deviation **03**
 (b) Design a knuckle joint to connect two mild steel bars under a tensile load of 25KN. The allowable stresses are 65MPa in tension 50MPa, in shear and 83MPa in crushing **07**

- Q.2** (a) 1. What is factor of safety? Which are the factors to be considered while selecting the same? **03**
 2. A rectangular bar of 40mmX60mm size is subjected to tensile load of 100KN. The factor of safety is 2. Select the suitable material from below given materials. **04**
 Mild Steel : Permissible tensile stress = 90MPa
 Cast Iron: Permissible tensile stress = 20MPa
 (b) A bracket carrying a load of 15KN is to be fillet welded as shown in Fig-1. Find the size of weld required if the allowable shear stress is not to exceed 80MPa. **07**

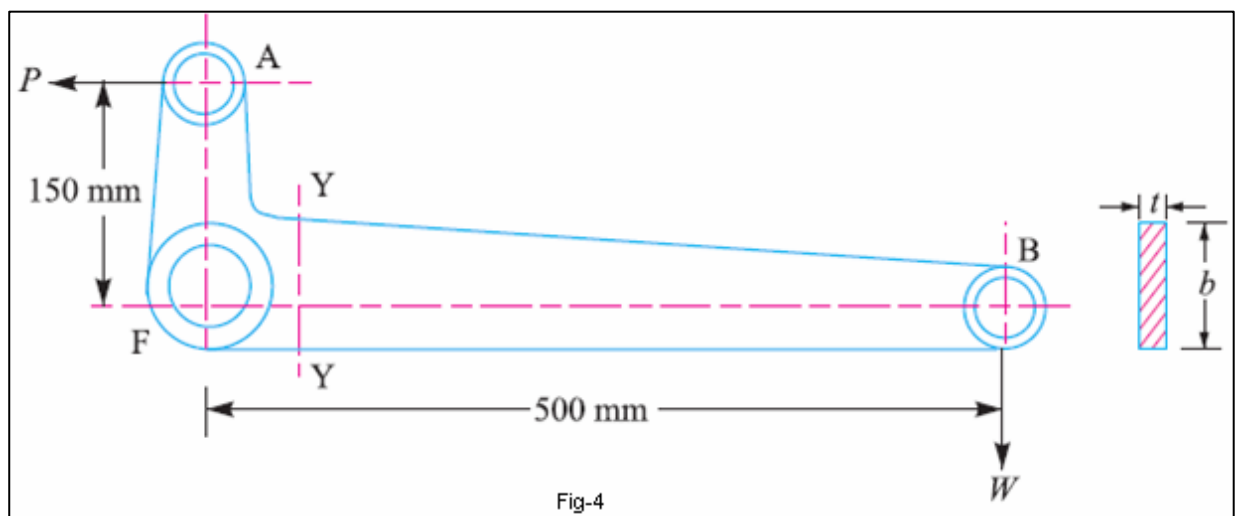
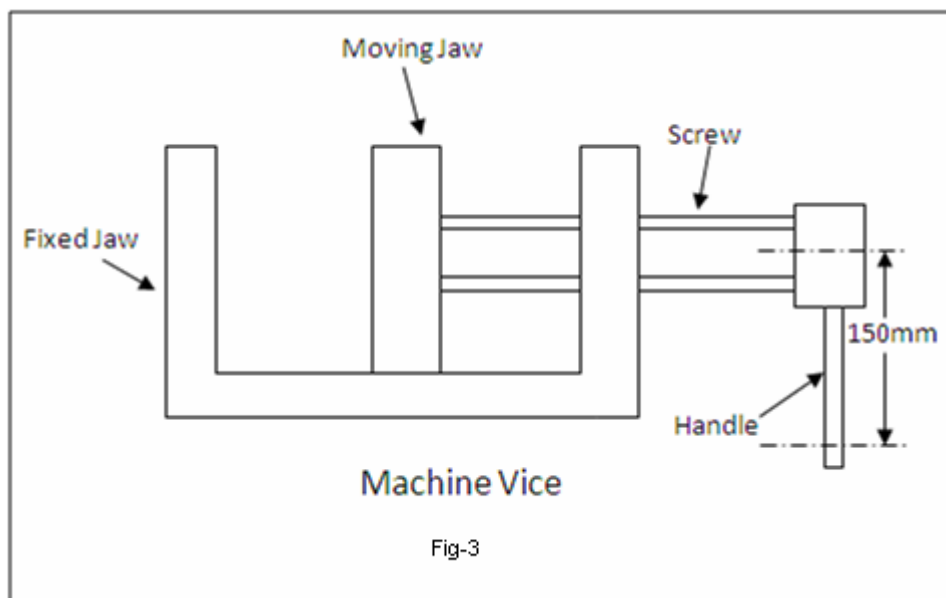
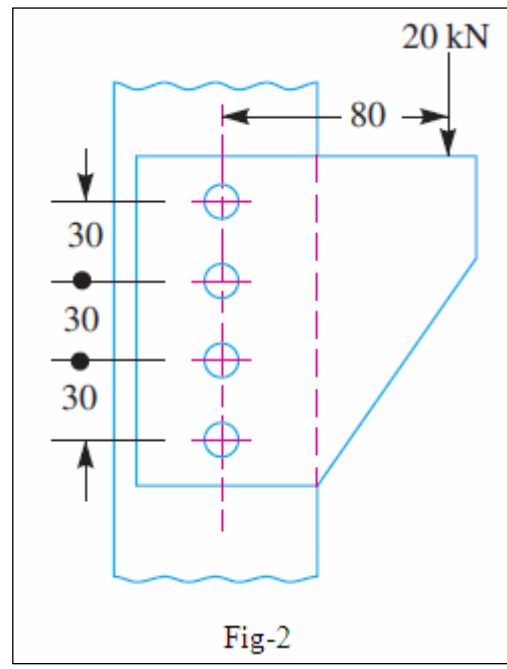
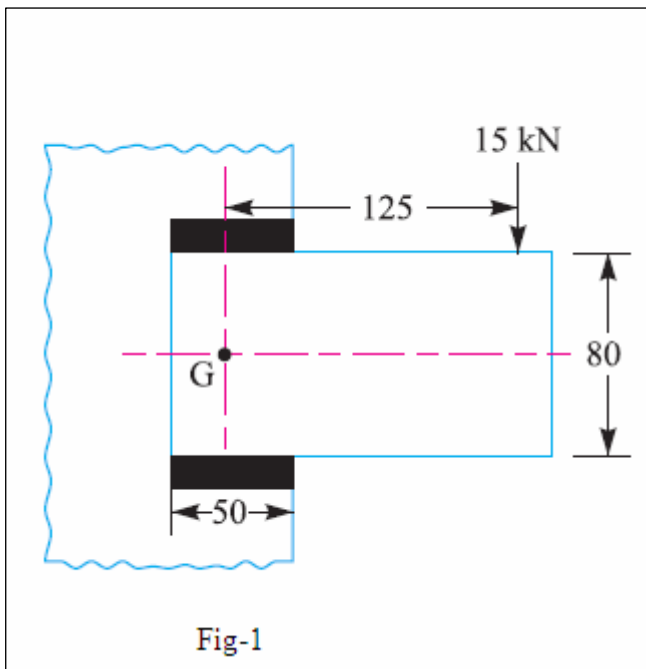
Take Polar moment of Inertia
$$J = \frac{\pi(3b^2 + l^2)}{6}$$

OR

- (b) A bracket is supported by means of four rivets of same size as shown in Fig-2. Determine the diameter of rivet if the maximum shear stress is 140MPa. **07**
- Q.3** (a) A lever loaded safety valve is 70mm in diameter and is to be designed for a boiler to blow off at pressure of 1N/mm² gauge. Design a suitable mild steel lever of rectangular cross section. For mild steel: Permissible tensile stress = 70MPa, Shear stress = 50MPa, Bearing pressure intensity = 25N/mm². The pin is also made of mild steel. The distance from the fulcrum to the weight of the lever is 880mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 80mm. **07**
 (b) A machine vice as shown in Fig-3 has single start square threads with 22mm nominal diameter and 5mm pitch. The outer and inner diameters of the friction collar are 55mm and 45mm respectively. The coefficient of friction for thread and collar are 0.15 and 0.17 respectively. The machinist can comfortably exert a force of 125N on the handle at a mean radius of 150mm. Assuming uniform wear for the collar calculate **07**
 1. Clamping force developed between the jaws
 2. The overall efficiency of the clamp

OR

- Q.3 (a)** A right angle bell crank lever is shown in Fig-4. The load $W = 4.5\text{KN}$. The lever consists of forged steel material and a pin at the fulcrum. Take the following permissible stress for the pin and lever material. Safe stress in tension = 75MPa , Safe stress in shear = 60MPa , Safe bearing pressure on pin = 10N/mm^2 . The length of fulcrum pin is 1.25 times the diameter of fulcrum pin. Calculate the following. **07**
1. Reaction at fulcrum pin
 2. Fulcrum pin dimensions
 3. Lever dimensions
- (b)** Explain the design process for socket and spigot cotter joint **07**
- Q.4 (a)** Explain different types of keys with its applications **07**
- (b)** Design a muff coupling to transmit 30KW at 100RPM . The allowable shear stress for the shaft and key is 40MPa and the number of bolts connecting the two halves are 6. The permissible tensile stress for the bolts is 70MPa . The coefficient of friction between the muff and the shaft surface may be taken as 0.3. Take width of key = Shaft diameter/4 and thickness of key = Shaft diameter/6 **07**
- OR**
- Q.4 (a)** Explain purpose and requirement of shaft coupling **07**
- (b)** Design a cast iron flange coupling for a mild steel shaft transmitting 90KW at 250RPM . The allowable shear stress in the shaft is 40MPa and the angle of twist is not to exceed 1 degree in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30MPa . Take width of key = Shaft diameter/4 and thickness of key = Shaft diameter/6. Assume number of bolts = 4 **07**
- Q.5 (a)** Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200N and is located at 300mm from the centre of the bearing. The diameter of the pulley is 200mm and the maximum power transmitted is 1KW at 120RPM . The angle of lap of the belt is 180 degree and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35MPa . **07**
- (b)** 1. Explain stress concentration and methods of reducing it by sketches **03**
2. Differentiate between assembly drawing and detailed drawing with simple example **04**
- OR**
- Q.5 (a)** Explain circle, arc, rectangle and polygon commands for Auto CAD drawing. With suitable example explain use of mirror command **07**
- (b)** 1. Draw the generalized surface roughness symbol showing position of different information on it **04**
2. Give symbol for straightness, flatness, perpendicularity, cylindricity, symmetry and angularity **03**



All Dimensions are in mm