

GUJARAT TECHNOLOGICAL UNIVERSITY**P.D.D.C. Sem- III Examination December 2010****Subject code: X31903****Subject Name: Machine Design & Industrial Drafting****Date: 15 /12 /2010****Time: 10.30 am – 01.00 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) Explain factor of safety and stress concentration factor. **07**
(b) A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN.m and a torsional moment of 30 kN.m. Determine the diameter of shaft using maximum shear stress theory and maximum strain energy theory. Take $E = 210$ GPa and Poisson's ratio = 0.25 **07**

- Q.2** (a) Design a knuckle joint to transmit 5 kN axial tensile load. Allowable stresses in the fork end, eye end and rod and pin are : allowable tensile stress = 50MPa, allowable shear stress = 40MPa, allowable bearing pressure = 80MPa, **07**
(b) What are the advantages of welded joint over riveted joints and Cast iron structures? **07**

OR

- (b) A double riveted, single row butt joint is used to connect two plates of thickness 22 mm each. The diameter of the rivets is 30 mm each. The pitch between the rivets is 100 mm. The load applied on the plates is such that the tensile stress developed in the plates is 75 MPa. What are the shearing and bearing stresses in the rivets? What is the thickness of the cover plates? **07**
- Q.3** (a) Design a sleeve coupling for the transmission of 12 kW at 300 rpm by two connected steel shafts. Take service factor $K_s = 1.25$. Take shear stresses in the key and shaft = 50 MPa, Crushing stress in the key = 100 MPa, Shear stress in the sleeve = 10 MPa. **07**
(b) 1. Explain critical speed of the shaft. **03**
2. Draw neat sketches of various types of keys and explain briefly. **04**

OR

- Q.3** (a) 1000 mm diameter pulley is keyed to a 50 mm shaft by a 14 mm square key of length 150 mm. the tension in the tight side of the belt is 5000 N and tension ratio is 2:1. Find the shear and compressive stress in the key. Also find the factor of safety by taking ultimate compressive strength 350 MN/m² and ultimate shear strength 250 MN/m². **07**
(b) 1. Explain torsional rigidity and lateral rigidity for shaft **03**
2. Explain design procedure for protected type rigid flange coupling. **04**

- Q.4** (a) Design a shaft to transmit 1 kW power at 120 r.p.m. through a pulley. The pulley having diameter of 200 mm weighs 200 N and is located at 300 mm from the centre of the bearing. The angle of lap for belt is 180° and co efficient of friction is 0.30. The shock and fatigue factor for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress may be taken as 35 MPa. **07**

- (b) 1. Explain various types of power screw threads. **04**
 2. Explain various types of levers with necessary sketch and give applications of each **03**

OR

- Q.4 (a)** Compare the weight, strength and stiffness of a hollow shaft of the same external diameter as that of solid shaft. The inside diameter of the hollow shaft being half the external diameter. Both the shafts have the same material and length **07**
- (b) 1. Explain Over Hauling and Self Locking screws. And show that the efficiency of self locking screws is less than 50%. **03**
 2. Explain the operation of rocker arm in I.C. engine **04**
- Q.5 (a)** Design a screw jack for lifting a load of 100 kN considering a maximum lift of 500 mm. Material for the screw is 30C8 steel with $\sigma_{uc} = 550$ MPa, $\sigma_y = 300$ MPa. For the nut $P_b = 15$ MPa. The body is of C.I. **07**
- (b) In a lever safety valve, the valve is of 80 mm diameter and is designed to blow off if the pressure exceeds 0.981 N/mm^2 . Design a suitable lever of mild steel, with rectangular section $b:h = 1:4$. Data for material of lever: Safe stress in tension = 80 MPa, Safe stress in shear = 40 MPa, Safe bearing pressure on bush = 15 N/mm^2 . **07**

OR

- Q.5 (a)** Design a right angled bell crank lever carrying 1000N load. The load arm is 250 mm long and effort arm is 400 mm. The lever is made of C.I. having tensile strength 20 MPa, compressive strength 100 MPa and shear strength 10 MPa and material for pin is 30C8 having tensile strength 90 MPa, compressive strength 100 MPa and shear strength 60 MPa and bearing pressure 20 MPa. **07**
- (b) Explain design procedure for toggle jack. **07**
