Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-III Examination-Dec.-2011

Subject code: 131902 **Date: 15/12/2011**

Subject Name: Machine Design & Industrial Drafting

Time: 2.30 pm -5.30 pm **Total marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Draw neat sketches to justify the answers.**

Q.1 **(a)** 1. Determine the minimum size of a circular hole that can be punched in a M.S. plate, 5 mm thick and having ultimate shear strength of 300 MPa. Take compressive strength of punch as 360 MPa. **03**

2. Define machine design. Explain different types of design problems stating suitable examples. **04**

(b) Answer the following (Any THREE) **:** **07**

(i) Define factor of safety. List and explain the factors affecting selection of it.

(ii) Explain the various steps of machine design process.

(iii) Explain the following materials giving their applications: FG200, 16Ni3Cr2, 40C8.

(iv) Distinguish clearly between bending and bearing stress.

(v) List and explain the factors affecting selection of suitable materials.

Q.2 **(a)** 1. Distinguish clearly between knuckle joint and gib and cotter joint. **03**

2. Explain the different methods used for reducing stress concentration with neat sketches. **04**

(b) It is required to design a knuckle joint to connect two circular mild steel rods subjected to an axial tensile load of 50KN. The design stresses are 80 MPa in tension and crushing and 40 MPa in shear for all the parts. **07**

OR

(b) It is required to design a cotter joint to connect two steel rods of equal diameter. Each rod is subjected to an axial tensile load of 50 kN. The permissible stresses are 67 MPa in tension, 34 MPa in shear and 134 MPa in crushing for all the parts. **07**

Q.3 **(a)** 1. How will you select the material for screw and nut while designing power screw? **03**

2. State and explain the failures of shafts stating the reasons. **04**

(b) The armature shaft of a 40 kW, 720 r.p.m. electric motor mounted on two bearings are as shown in Fig.no.1.the total magnetic pull on the armature is **07**

7 kN and it is assumed to be uniformly distributed over a length of 700 mm midway between the bearings. The shaft is made-up of steel with an ultimate tensile strength of 770 MPa and yield strength of 580 MPa.Determine the shaft diameter using ASME code if, $k_b = 1.5$ and $k_t = 1.0$ Assumed that the pulley is keyed to the shaft.

OR

Q.3 **(a)** 1.Explain the different types of threads used in power screw stating their **03**

applications.

2.Explain the design of shaft based on strength and rigidity as per A.S.M.E. code. **04**

(b) Design a toggle jack for lifting a load of 4 kN for an axial adjustment between two nuts is limited between 50 mm to 210 mm.The eight links of the jack are symmetrical and 110 mm long. The links pins in the base are set 30 mm apart. The design stresses for screw, pins and links are 100 MPa in tension and 50 MPa in shear. The bearing pressure on the pins is limited to 20 MPa.The coefficient of friction for threads are 0.20. **07**

Standard size of square threads

Nominal dia.(mm)	Minor dia. (mm)	Pitch (mm)	core area (mm^2)
20	14		164
22	16		204
24	18	6	254
26	20		314
28	22		380

Q.4 **(a)** 1. compare the strengths of square key and rectangular key. **03**

2. What is splined shaft? Explain the design of splined shaft. **04**

(b) Design a rocker arm lever having equal arms of 160 mm length inclined at 135^0 for an exhaust valve of a gas engine subjected to a maximum force of 2500 N at roller end. Consider – I cross section 6t x 2.5t x t size (where t = thickness of web and flange) for lever. The permissible stresses for the lever material are 80MPa in tension and design bearing pressure is pin 6 MPa for pin. **07**

OR

Q.4 **(a)** 1. State and explain the different functions of levers. **03**

2. Explain the different failures of riveted joints. **04**

Q.4 **(b)** Design a bush pin type protected flexible flange coupling to connect the output shaft of an electric motor to the shaft of a centrifugal pump. The motor delivers 20 kW power at 720 r.p.m. The starting torque of motor can be assumed to be 150 % of the rated torque. The permissible stresses are as under : **07**

95MPa in shear for shaft, 100MPa in shear and 300MPa in crushing for key, 200MPa in tension and 35MPa in shear for pin and 17MPa in shear for flanges.

Consider the No. of pins = 6

Q.5 **(a)** 1. Explain assembly drawing in detail. **03**

2. Write briefly about fits and tolerances used in design. **04**

(b) Explain the following commands : **07**

Circle, arc, scalling, mirror, trim.

OR

Q.5 **(a)** 1. Explain production drawing in detail. **03**

2. Write briefly about roughness and machining symbols and their indication on drawings. **04**

(b) A welded joint has to support a load of 80 kN. Suggest a suitable size of fillet weld if the safe shear stress for the weld material is 80 MPa. Refer Fig. No.2. **07**

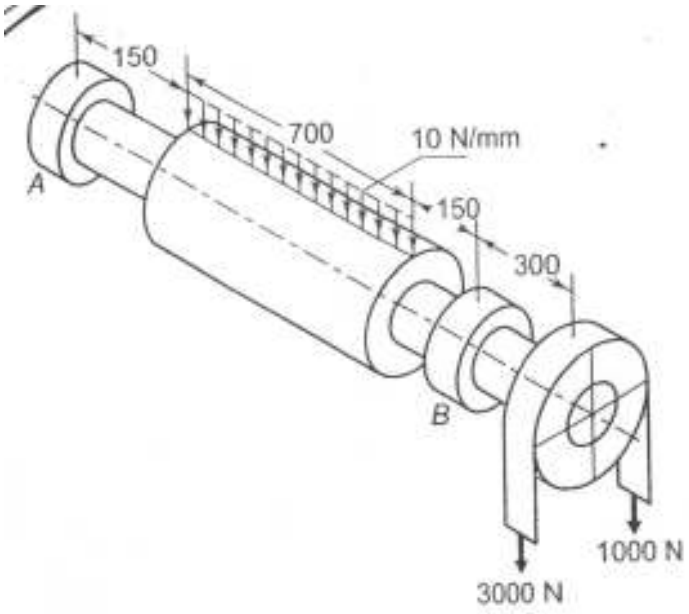

Fig No.1 Question 3(b)

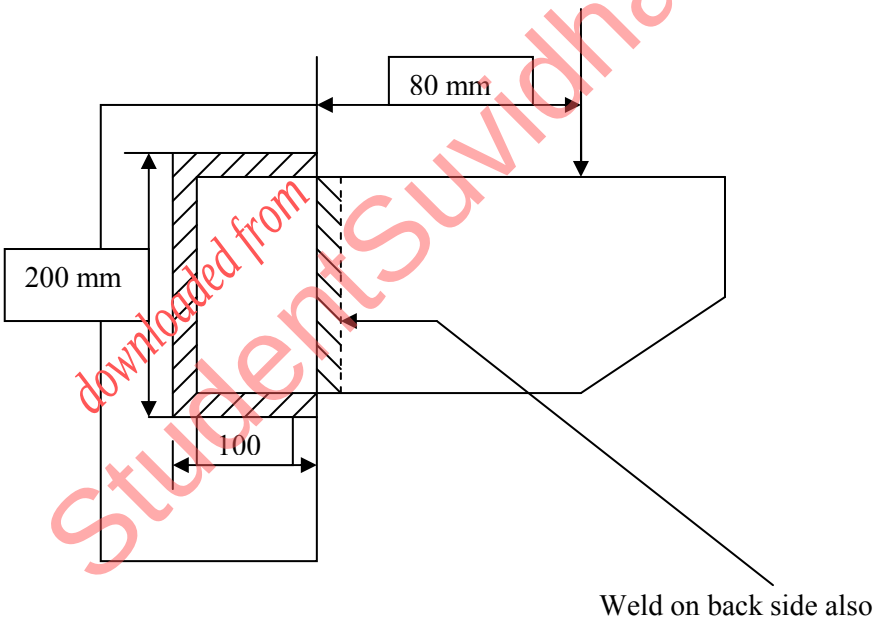

Fig No.2 Question 5 (b)

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