Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–V • EXAMINATION – SUMMER 2013

Subject Code: X 51903 Date: 16-05-2013

Subject Name: Machine Design-I

Time: 02.30 pm - 05.00 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 in detail manufacturing considerations in designing a welding. **07**

(b) Explain in detail manufacturing considerations in design of components for casting. **07**

Q.2 **(a)** Explain with neat sketch different types of springs with suitable example of each type. **07**

(b) Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 KN and a minimum value of 100 KN. The properties of the plate material are as follows: Endurance limit stress = 225 N/mm^2, and Yield point stress = 300 N/mm^2. The factor of safety based on yield point may be taken as 1.5. **07**

OR

(b) What is stress concentration? Explain different methods of reducing stress concentration in machine parts. **07**

Q.3 **(a)** Differentiate between antifriction and journal bearings. **07**

(b) Design a self-aligning ball bearing for a radial load of 7000 N and a thrust load of 2100 N. The desired life of the bearing is 160 millions of revolutions at 300 rpm. Assume radial and axial load factors to be 1.0 and 1.5 respectively and inner race rotates uniform. **07**

OR

Q.3 **(a)** Derive an expression for torque transmitting capacity of plate clutch considering uniform wear theory. **07**

(b) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 rpm. Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255, ratio of diameters is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also, determine the axial thrust to be provided by springs. Assume uniform wear theory. **07**

Q.4 **(a)** A hydraulic press has a maximum capacity of 1000 KN. The piston diameter is 250 mm. Calculate the wall thickness if the cylinder is made of material for which the permissible strength may be taken as 80 MPa. This material may be assumed as a brittle material. **07**

(b) Power of 60 kW at 750 rpm is to be transmitted from an electric motor to compressor shaft at 300 rpm by V-belts. The approximate larger pulley diameter is 1500 mm. The approximate centre distance is 1.650 m, and overload factor is to be taken as 1.5. Determine number of belts required. A belt with cross-sectional area of 350 mm^2 and density 1000 kg / m^3 and having an allowable tensile strength 2 MPa is available for use. The **07**

coefficient of friction between the belt and the pulley may be taken as 0.28.

OR

Q.4 **(a)** Write a short note on internal expanding shoe brake. **07**

Q.4 **(b)** Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 N/mm^2 and modulus of rigidity, G = 84 kN/mm^2. Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils. **07**

Q.5 **(a)** Prove that the ratio of the driving tensions on the two sides of a pulley is $T_1/T_2 = e^{\mu\theta}$ **07**

Where, T_1 = Tension in the tight side of the belt,

T_2 = Tension in the slack side of the belt

θ = Angle of contact in radians

μ = coefficient of friction between the belt and pulley.

(b) A 150 mm diameter shaft supporting a load of 10 KN has a speed of 1500 rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diametral clearance of the bearing is 0.15 mm and the absolute viscosity of the oil at the operating temperature is 0.011 kg/m-s, find the power wasted in friction. **07**

OR

Q.5 **(a)** Write a short note on multi-leaf spring. **07**

(b) Explain with neat sketch different types of end closures used in pressure vessels **07**

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