Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Examination January 2010

Subject code: 710801 **Subject Name: Advanced Machine Design**
Date: 20 / 01 / 2010 **Time: 12.00 – 2.30 pm**
Total Marks: 60

Instructions:

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

Q.1 **(a)** Explain with neat sketch and suitable example Product life cycle. **06**

(b) Explain in brief i. Concurrent Engineering **06**
ii. Ethics in Engineering Design.

Q.2 **(a)** What is cumulative fatique damage? Explain the linear damage rule. **06**

(b) What is mechanical reliability? Explain the terms i. Hazard rate ii. MTBF **06**

OR

(b) The work cycle of a mechanical component subjected to completely reversed bending stresses consist of the following three elements; **06**

(i) $\pm$ 350 N/mm^2 for 85 % of time
(ii) $\pm$ 400 N/mm^2 for 12 % of time
(iii)$\pm$ 500 N/mm^2 for 3 % of time

The material for the component is 50C4 having ultimate tensile strength 660 N/mm^2 and the corrected endurance strength of the component is 280 N/mm^2. Determine the life of the component.

Q.3 **(a)** A precision milling machine is supported on four shock mounts, as shown in **figure 3.1**. The elasticity and damping of each shock mount can be modeled as a spring and a viscous damper, as shown in **figure 3.2**. Find the equivalent spring constant K_{eq} and the equivalent damping constant C_{eq} of the machine tool support in terms of the spring constant K_i and damping constant C_i of the mounts. **06**

(b) Explain the concept "Design for Assembly". **06**

OR

Q.3 **(a)** Why the gear profile is corrected? Explain characteristics of corrected gears. **06**

(b) Design a pair of CI gear to transmit 12 KW having pinion speed of 200 rpm. The speed reduction is 2:1. Assume face width is three times the circular pitch. The number of teeth on pinion is 24. Take pressure angle is 14.5^0. The modulus of elasticity for pinion is 0.8 X 10^5 N/mm^2. Errors in manufacturing is not to exceed 0.05 mm. The allowable bending stress for CI is 45 N/mm^2. Take elastic stress as 81 N/mm^2 and surface endurance limit 280 N/mm^2 for gear pair. Check the design for all failures. **06**

Q.4 **(a)** Explain the stress distribution in solid rotating disc. **06**

(b) A disc of uniform thickness 500 mm diameter rotates at 5500 rpm. Determine the maximum hoop stress and radial stress and draw the curves showing their variation, if the disc has a central hole of 50 mm diameter. Assume density of disc material is 7.86 gm/cm^3, poisons ration = 0.3 and E = 200 KN/mm^2. **06**

OR

Q.4 **(a)** A high pressure cylinder consists of a steel tube with inner and outer diameters of 25 mm and 45 mm respectively. It is jacketed by an outer steel tube with an outer diameter of 65 mm. The tubes are assembled by a shrinking process in such a way that the maximum principal stress induced in any tube is limited to 100 N/mm^2. Calculate the interference pressure and original dimensions of the tubes. Take E = 207 KN/mm^2 **06**

(b) Explain in detail "Pressure Vessel Testing". **06**

Q.5 **(a)** Explain in brief, "Recent trends in Material handling equipment design" **06**

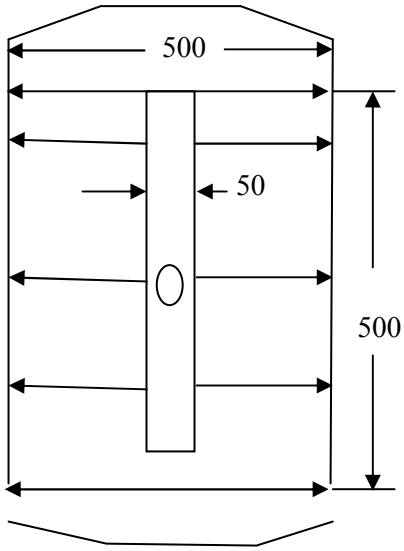
(b) A 75 mm diameter full journal bearing runs at 450 rpm. It is 75 mm long and is subjected to a radial load of 2500 N. The bearing is lubricated with SAE 30 oil which flows into the bearing at a temperature of 75^0 C. The radial clearance is 0.03 mm. Calculate power lost in friction and temperature rise. Take at temp 75^0 C and for SAE 30 oil viscosity as 0.0165 X 10^{-6} N / mm^2. **06**

OR

Q.5 **(a)** Explain design procedure for the design of main girder with necessary design equations. **06**

(b) The developed view of a hydrostatic bearing is shown in **figure 5.1**. Consider the flow in the direction shown by arrows and neglect the flow in the other direction and over corners. The pressure distribution is linear as shown in **figure 5.2.** The thrust load is 500 KN and the film thickness is 0.2 mm. the viscosity of the lubricant is 500 centipoise. Calculate the supply pressure and flow requirement. **06**

All dimensions are in mm.



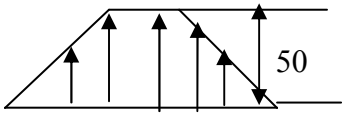


Figure 5.2

Figure 5.1

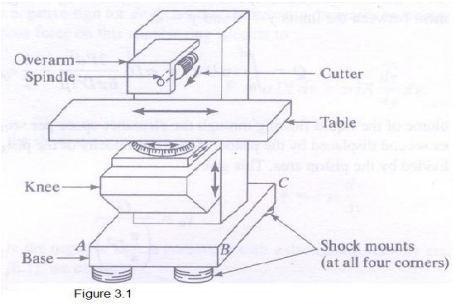


Figure 3.1

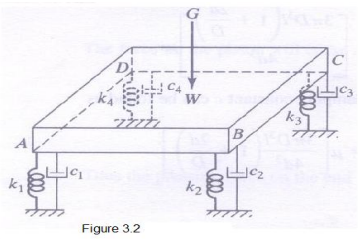


Figure 3.2

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