GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2014

Subject Code: 710801 Date: 13-06-2014 **Subject Name: Advanced Machine Design** 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. (a) Evaluate the statement õBrain storming -a creativity method for product developmentö. 07 0.1 (b) Explain the safe life and fail safe design concepts giving suitable examples. 07 07 **Q.2** (a) Explain the design for manufacturing and assembly with suitable example. (b) Explain importance of concurrent engineering in increasing QFD of a product design. 07 OR (b) What is mechanical reliability? Explain the terms. (a) Hazard rate (b) MTBF 07 (a) A pair of parallel helical gears consists of 24 teeth pinion rotating at 5000 rpm and 07 **Q.3** supplying 2.5 kw power to a gear. The speed reduction is 4:1. The normal Pressure angle and helix angle are 20° and 23° respectively. Both gears are made of hardened steel (S_{ut} ó 750 N/mm²) The service factor and FOS are 1.5 and 2 respectively. The grades are finished to meet the accuracy of grade ó 4. (i) In the initial stages of gear design, assume that the velocity factor accounts for the dynamic load and that face width is 10 times the normal module. Assuming the pitch line velocity to be 10 m/s, estimate the normal module. Determine the dynamic load using Buckinghamøs equations and find out the (ii) effective load. What is the correct FOS for bending? (b) Why the gear profile is corrected? Explain characteristics of corrected gears. 07 OR (a) State and explain the following concept related to material handling equipment. Q.3 07 1 space utilization concept 2 unit load concept (b) Design a crane hook for lifting capacity of 5 tonnes. It is made from forged steel and has 07 approximate triangular section. Take permissible tensile stress 80 N/mm² for forged steel. 07 (a) Explain the testing of pressure vessel as per BIS. **Q.4** (b) A tube with 50 mm and 75 mm as inner and outer diameters respectively, is reinforced 07 by shrinking a jacket with an outer diameter of 100 mm. The compound tube is to withstand an internal pressure of 35 Mpa. The shrinkage allowance is such that the maximum tangential stress in each tube has same magnitude. Calculate (i) the shrinkage pressure and (ii) the original dimensions of tubes. Show the distribution of tangential stresses. Assume $E = 207 \text{ kN} / \text{mm}^2$. OR **Q.4** (a) Derive the equation for stresses in the rotating disc? 07 (b) A steel disc of uniform thickness has internal and external diameter of 100 mm and 600 **Q.4** 07 mm respectively. Find the speed of rotation if the maximum hoop stress induced in the

disc is 60 Mpa. Also find the maximum value radial stress and the radius at which it

occurs. Take $\mu = 0.3$ and $\rho = 7400$ kg/m³.

- Q.5 (a) A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 07 N/mm^2 . The speed of the journal is 900 rpm. And the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature 75[°] C may be taken as 0.011-kg/ m-s. The room temperature is 35[°]C. Find: 1. The amount of artificial cooling required 2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10[°]C. Take specific heat of the oil as 1850 J /kg /[°]C.
 - 07

07

OR

Q.5 (a) Explain the following terms related to bearing.
(a) Bearing characteristics number (b) Bearing modulus (c) Life of bearing

(b) Explain: Wedge film and squeeze film journal bearings.

(b) A support rod in a boiler carries a constant tensile stress of 68 MPa. The rod is made of 07 medium carbon steel for which following data are available.

Strain rate (hr ⁻¹)	Stress (MPa)	Temp (0 C)
5 X 10 ⁻³	136	540
5 X 10 ⁻⁷	41	540

Calculate the life time of the rod at 540 0 C before it elongates by 10%.
