Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 710801N **Date:16/05/2016**

Subject Name: Advanced Machine Design

Time:02:30 pm to 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)**	State and explain the principles of design for manufacturing and assembly.	**07**
	(b)	With the help of a suitable example, explain mechanism of Quality Function Deployment (QFD) to satisfy customer requirements.	**07**
Q.2	**(a)**	**(i)** What are the principles of ethics in engineering design?	**04**
		(ii) Explain the following terms: (a) Brainstorming (b) Whistle blowing (c) Intellectual property	**03**
	(b)	A single raw deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The values of X and Y factors are 0.56 and 1.5 respectively. The shaft rotates at 1200 rpm. The diameter of the shaft is 75 mm and bearing No. 6315 (C=112000 N) is selected for this application. (i) Estimate the life of the bearing, with 90% reliability. (ii) Estimate the reliability for 20 000 hours life.	**07**
		OR	
	(b)	Distinguish between Technological development cycle and Product development cycle for a new product development.	**07**
Q.3	**(a)**	What is profile correction of gears? Explain S_0 and S corrected gears with characteristics of corrected gears.	**07**
	(b)	A pair of spur gears with 20^0 full depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of 600 N/mm^2. The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for the dynamic load and the factor of safety is 1.5. Determine the rated power that gears can transmit.	**07**
		OR	
Q.3	**(a)**	What is Autofrettage? Describe three methods of prestressing the cylinder. What are the advantages of Autofrettage?	**07**
	(b)	A high pressure vessel cylinder consists of a steel tube with inner and outer diameter of 20 and 40 mm respectively. It is jacketed by an outer steel tube, having an outer diameter of 60 mm. The tubes are assembled by a shrinking process in such a way that maximum principle stress induced in any tube is limited to 100 N/mm^2. Calculate the shrinkage pressure and original dimensions of the tubes (E= 207 kN/mm^2).	**07**
Q.4	**(a)**	What is creep? Explain mathematical representation of creep curves with its Significances in design.	**07**

(b) A chemical reaction chamber working at a temperature of 500 ^{0}C uses steel bolts to tighten the two parts. The test on bolt material at this temperature resulted into strain rates of 3 x 10^{-18} /hour and 2 x 10^{-18} /hour at 30 MPa and 25 MPa stress levels respectively. If the bolts are tightened to a stress level 68 MPa initially, calculate in what time the stress will be reduced to half this value. Assume that the chamber is made of same material and flange is very rigid. Modulus of elasticity E at 500 ^{0}C is equal to 1.7 x 10^5 MPa. **07**

OR

Q.4 **(a)** State and explain the following concept related to material handling equipment. **07**

1 Space utilization concept

2 Unit load concept

(b) Determine the diameter of a circular rod made of a ductile material having fatigue strength of 265 MPa and yield strength of 350 MPa. The member is subjected to varying axial load between P_{min} = -300 kN to P_{max} = 700 kN. The fatigue strength factor due to stress concentration is 1.8. Assume factor of safety of 2.0. Consider reliability factor=1.229 and Surface finish factor = 1. **07**

Q.5 **(a)** Define thick film and thin film lubrication. Differentiate between hydrodynamic and hydrostatic lubrication. **07**

(b) A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 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 of 75 ^{0}C may be taken as 0.011kg/m-s. The room temperature is 35 ^{0}C. Find: 1. The amount of artificial cooling required 2. The mass of lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10 ^{0}C. Take specific heat of the oil as 1850 J/kg/^{0}C **07**

OR

Q.5 **(a)** Explain the design procedure for rotating long cylinder assuming the ends of cylinder are fixed with usual notations. **07**

(b) Explain the design procedure of crane hook with usual notations. Why trapezoidal cross section is more preferable in design of crane hook? **07**

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