Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Remedial Examination April 2010

Subject code: 710801

Subject Name: Advance Machine Design

Date: 06 / 04 / 2010 **Time: 12.00 noon – 02.30 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)** Classify material handling equipment. State technical factors responsible for choice of material handling equipment. Give applications of material handling equipment **06**

(b) Prove the equation for disk of uniform strength **06**

$$\ln (l_a / l_b) = (\rho\omega^2 b^2) / (2\,\sigma_b)$$

Where l_a = Width at center

l_b = width at rim

ω= Angular speed

b= Radius at outer periphery

ρ= material density

σ_b=stress value for material

a= Radius at inner periphery=Assume zero

Q.2 **(a)** The cover of a cylindrical pressure vessel made of cast iron is of 25mm thickness. The cylinder and gasket are made of cast iron and zinc whose thicknesses are 25mm and 5mm respectively. The inner diameter is 500mm, and the internal pressure is limited to 2 Mpa. The cover is fixed to the cylinder by means of 16 bolts of nominal diameter 20 mm. Each bolt is initially tightened with a preload of 20 kN. The bolts are made of steel FeE 250 (σ_{yt}=250N/mm^2) **06**

Assume

E_{steel} =207 kN/mm^2

$E_{cast\ iron}$ =100kN/mm^2

E_{zinc} =90kN/mm^2

Determine the factor of safety for bolts considering the effect of the gasket.

(b) A thin steel disk is to be used at 14000 r.p.m. as a rotating blade for cutting blocks of paper. It will be of uniform thickness excepts where sharpened at the periphery. The outside diameter may be taken as 250 mm.The disk is mounted on a shaft of 56 mm diameter and clamped rigidly. Material of disk is AISI 1060, Unquenched with σ_y =480 Mpa .Determine significant stresses and factor of safety as per maximum shear stress theory of failure. Take Poisson's ratio for disk material is 0.3. **06**

OR

(b) Explain the term related with Machine design **06**

Product life cycle, Ethics in design, Brain storming.

Q.3 **(a)** Define thick film and thin film lubrication. Differentiate between hydrodynamic and hydrostatic lubrication. **06**

(b) Design a bearing and journal to support a load of 4500 N at 600 rev/min using a hardened steel journal and a bronze backed Babbitt bearing. The bearing is lubricated by oil rings. Take room temp.as 21° C and oil temp.as 80 ^{o} C. Take the absolute viscosity of the oil is 0.01 kg/ms and minimum bearing modulus for the journal and bearing is 2.85.Take the operating bearing modulus=3 times Minimum bearing modulus, L/D ratio=1, diametral clearance ratio= 0.001 and factor to correct for end leakage=0.002 for the above case. **06**

OR

Q.3	**(a)**	(i)Define friction. Discuss methods to reduce friction.	**03**
		(ii)Define Wear. Discuss types of wear.	**03**
	(b)	Write down the assumption taken in determining static load carrying capacity of bearing, and prove the equation to find out static load carrying capacity of rolling contact bearing.	**06**
Q.4	**(a)**	A pair of cast iron involute spur gear is to be designed to transmit 11.2 kW. Pinion has 24 teeth and runs at 200r.p.m.Velocity ratio is 3 and face width of the gear is three times the circular pitch. Pressure angle is 14.5^{o}.Desing the Gears. If form factor is given as {0.124-(0.684/Z)} and Working stress is {(50 X 200)/(200+V)}.The Notation given in the equation has usual meaning.	**06**
	(b)	(i) Explain the design of machine tool spindle based on strength and rigidity criteria.	**04**
		(ii)What is creep? Why it occurs?	**02**

OR

Q.4	**(a)**	(i) Write a short note on Gear material selection.	**05**
		(ii) Write the names of gear manufacturing methods.	**01**
	(b)	Helical gear of cast steel is required to transmit 37.5 kW at 1800 r.p.m. The helix angle is 30°.If the gear has 24 teeth, determine the necessary diametral pitch, pitch diameter and the width of 20° full depth teeth. The allowable static stress for the gear material may be taken as 50 N/mm^2 .The width of face, parallel to the axis may be taken as 4 times the circular pitch. Estimate the end thrust on the gear. Assume additional data if required.	**06**
Q.5	**(a)**	A car moving over a rough road can be modeled considering (i) Weight of the car body, Passengers, Seats, Front wheels: (ii) Elasticity of Tires (suspension), Main spring and Seats. (iii) Damping of the Seats, Shock absorbers and Tires. Develop three mathematical models of the system.	**06**
	(b)	(i) Write a short note on concurrent Engg.	**03**
		(ii) Write down the basic rules followed during the design of casting.	**03**

OR

Q.5	**(a)**	(i) Define Reliability Write down the equation to find out overall reliability for the (i) n components are in series. (ii) n components are parallel.	**03**
		(ii) Explain with neat sketch limits, fits and tolerances.	**03**
	(b)	(i) Define fatigue failure.	**02**
		(ii) Discuss about ergonomics and aesthetic consideration in machine design.	**04**

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