Exam Seat No:_____ **Enrollment No:**_____

C.U.SHAH UNIVERSITY

WADHWAN CITY

University (Winter) Examination -2013

Course Name :M.Tech(Mech-CAD/CAM)Sem-I **Subject Name: -Advanced Machine Design** **Duration :- 2:30 Hours**

Date : 13/1/2014 **Marks : 70**

Instructions:-

(1) Attempt all Questions of both sections in same answer book / Supplementary.

(2) Use of Programmable calculator & any other electronic instrument is prohibited.

(3) Instructions written on main answer Book are strictly to be obeyed.

(4) Draw neat diagrams & figures (If necessary) at right places.

(5) Assume suitable & Perfect data if needed.

SECTION-I

Q-1 Attempt the following.

1. In multispeed gearbox, geometric progression ratio is selected in the range of 1 to 2.Justify. 01
2. Discuss Concurrent Engineering 02
3. What is wear? Enlist the types of wear. 02
4. Discuss Quality Loss Function 02

Q-2 (a) What is mechanical reliability? Explain causes for Unreliability. 04

(b) Explain the performance parameters affecting the design of hydrodynamic journal bearing. 05

(c) Design tensile bar of the length L=200 mm to carry a tensile load of 5 kN for minimum cost, out the following materials: 05

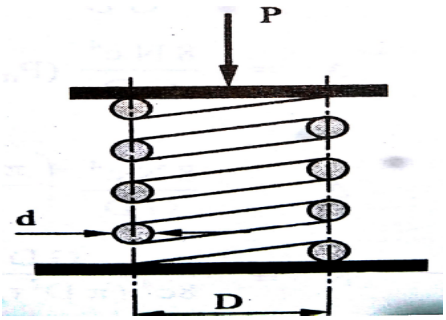
Material	Mass Density (kg/m^3)	Material Cost (Rs/N Weight)	Yield strength (MPa)
Steel	7500	16	130
Alu.Alloy	3000	32	50
Titanium Alloy	4800	480	90
Magnesium Alloy	2100	32	20

OR

Q-2 (a) Enlist the different theories of friction. Explain Bowden-Tabor adhesion theory of friction. 04

(b) Following Data refer to a journal bearing: Journal Diameter=80 mm,Length of bearing =100 mm, Bearing Load=10 kN,Radial clearance =0.04 mm, Absolute viscocity of oil=$21*10^{-3}$ PaS at 70°C,Room temp.=33°C,Specific heat of oil=1760 j/kg °C,Speed of the shaft=750 rpm, Heat dissipation coefficient Cd=350 w/m^2 °C. Find 1) Coefficient of friction 2) Power lost in friction 3) Minimum Oil film thickness. 05

(c) Prove that for a given helical spring in the following figures , minimum weight for given conditions occurs when the spring is so designed that the maximum load on it equal to twice the initial load. 05



Q-3 (a) Design a suitable speed gearbox for a headstock of a lathe that has a variation of speed from 105 rpm to 690 rpm in 9 steps. if the gearbox is driven by 10kW ,1000 rpm electric motor and the input shaft through v-belt drive, having speed reduction of 2:1 .Draw the structural diagram ,Speed chart and determine the number of teeth on each gears. 07

(b) The following data refers to an E.O.T. crane,Capacity = 75 KN,Span = 25 m,Crane Structure = double girder box,Duty class = Class III, Heavy Duty,Box section details,,Depth of section = 1.5 m,Thickness of section = 15 mm ,Width of section = 0.50 m,Bending moment on each girder = 1000 KN-m,Twisting moment on each girder = 600 KN-m,Weight/unit length of girder = 1.5 KN/m,Weight of trolley & Load = 100 KN,Width of trolley = 2.25 m,E = 2.2 x 10^5 MPa.Design the E.O.T. Crane. 07

OR

Q-3 (a) 1) Classify the Material handling equipment. 03
2) Explain Factors affecting selection of material handling equipments. 04

(b) A three stage, twelve speed gear box is to be designed for spindle speed varying between 60 rpm and 2880 rpm.The second stage consist of three speed steps. if the gearbox is driven by 5kW ,1440 rpm electric motor: 07
Draw 1) Ray diagram and 2) Gearing (Kinematic) diagram 3) Determine the Number of teeth on gears. Assume same module for all gears.

SECTION-II

Q-4 Attempt the following.

1. Define strength and rigidity. 02
2. Enlist the basic requirements related to spindle unit 02
3. What is Autofrettage? What are the methods of pre-stressing the cylinder? 02
4. What is Engineering Design? 01

Q-5 (a) Enlist fatigue design criteria and explain any two. 04

(b) For the given state of stress, determine the principal stresses and their direction. 05

$$[\tau_{ij}] = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

(c) A steel disc of uniform thickness has 500 mm external diameter and 100 mm diameter hole a the centre .Find the speed of the rotation about the axis perpendicular to plane of disc which will produce a maximum hoop stress of 90 Mpa.Find the value of maximum radial stress and the the radius at which it occurs.Assume density of disc material is 7800 kg/m^3, poisons ratio = 0.3. 05

OR

Q-5 (a) What is Robustness Strategy? Explain Tools used in robust design. 04

(b) The displacement field for a body is given by 05
$u= (x^2+y)i + (3+z)j + (x^2+2y)k.$
Write down the displacement gradient matrix at point (2,3,1)

(c) The piston rod of the hydraulic cylinder exerts an operating force of 10 Kn.The effect of friction =10 % piston force. The pressure in cylinder is 10 MPa.The cylinder is made of cast iron FG200 and F.O.S. =5.Determine the diameter and thickness of cylinder. 05

Q-6 (a) 1) Explain Profile correction of gears. 03

2) What do you mean by power rating of gears? Explain the gear rating as per BIS-4460-1967 in detail. 04

(b) Discuss the effect of machine tool compliance on machining accuracy and the basic design Considerations for spindle design in detail with neat sketches. 07

OR

Q-6 (a) 1) Explain the functions of machine spindle. 02

2) The spindle of high speed precision lathe has a diameter 80 mm and can run at a speed up to 2500 rpm. Check the suitability of aluminium alloy as a suitable sleeve bearing material for the above spindle if the maximum load on the bearing is 300 N and the length to diameter ratio of journal is 1. The aluminium alloy has permissible value of cutting speed, permissible bearing pressure intensity of 12 m/s and 2500 N/cm^2 respectively. 05

(b) A Pair of spur gears is required to reduce speed from 500 to 100 rpm for 12 hr running time per day continuously. The pinion is of 0.40% carbon steel and has 20 teeth. The wheel is of cast iron, grade 20 IS: 210, and has 100 teeth. The gears are of 8 module, 100 mm tooth width and 20 degree pressure angle. It is required to determine the allowable horsepower of the pair. Use following table value. 07

Where
X_b=Speed Factor for strength
Xc=Speed factor for wear
Yz=Zone factor
Y=strength factor
S_b=Bending stress factor
Sc=Surface stress factor.

Factor	X_b	Xc	S_b	Sc	Y	Yz
Pinion	0.3175	0.305	14.05	1.125	0.72	2.2
Gear	0.42	0.400	4.22	0.81	0.615	2.2

*********13***14*******