Enrollment No: _____ Exam Seat No: _____

C.U.SHAH UNIVERSITY
Winter Examination-2018

Subject Name: Advanced Machine Design

Subject Code: 5TE01AMD1 Branch: M.Tech Mechanical (CAD/CAM)

Semester: 1 Date: 03/12/2018 Time: 02:30 To 05:30 Marks: 70

Instructions:

(1) Use of Programmable calculator and any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

SECTION – I

Q-1 **Attempt the Following questions.**

(a) Define mechanical reliability. **(01)**

(b) Which are the functions of spindle? **(02)**

(c) Define Safe life and fail safe design strategies. **(02)**

(d) What is preloaded bearing? **(02)**

Q-2 **Attempt all questions**

(a) Explain design for strength and rigidity. **(07)**

(b) The state of stress at a point is characterised by the components **(07)**
$\sigma_x = 100$ MPa, $\sigma_y = -40$ MPa, $\sigma_z = 80$ MPa, $\tau_{xy} = \tau_{yz} = \tau_{zx} = 0$
Determine the extremum values of the shear stresses, their associated normal stresses, the octahedral shear stress and its associated normal stress.

OR

Q-2 **Attempt all questions**

(a) State and explain the principles of design for assembly. **(07)**

(b) A 70 mm diameter shaft is made of carbon steel having $\sigma_{ut} = 630$ Mpa, and $\sigma_y = 510$ Mpa. It is subjected to a torque between 2 kNm to 0.6 kNm. Using Soderburg method, find the factor of safety. Take $k_{sur} = 0.87$, $k_{size} = 0.8$, fatigue stress concentration factor $k_f = 1.1$, $\sigma_e = 0.5\ \sigma_{ut}$, $\tau_e = 0.55\ \sigma_e$, $\tau_y = 0.55\ \sigma_y$. **(07)**

Q-3 **Attempt all questions**

(a) Enlist the different theories of friction. Explain Bowden-Tabor adhesion theory of friction. **(07)**

(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-3 **Attempt all questions**

(a) What is profile correction of gears? Explain characteristics of corrected gears. **(07)**

(b) Following Data refers to a journal bearing: Journal Diameter = 80 mm, Length of bearing = 100 mm, Bearing Load = 10 kN, Radial clearance = 0.04 mm, Absolute **(07)**

viscosity of oil = $21x10^{-3}$ 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 C_d = 350 w/m^2 °C. Find 1) Coefficient of friction, 2) Power lost in friction, 3) Minimum Oil film thickness.

SECTION – II

Q-4 **Attempt the Following questions**

(a) What do you understand by unit load and bulk load in material handling? **(01)**

(b) What is Autofrettage? **(02)**

(c) Define Optimum and Adequate design. **(02)**

(d) Why multi- speed gear boxes are required in machine tools? **(02)**

Q-5 **Attempt all questions**

(a) State and explain the different principles used for designing the material handling equipments in detail. **(07)**

(b) Design an eight speed sliding gear box for a drill press for the following specifications: Minimum speed = 80 rpm., Maximum speed = 900 rpm., Motor power = 7.5 kw at 1440 rpm., reduction through V- belt drive between motor and input shaft =1:2. **(07)**
Calculate: (1) Standard spindle speeds (2) Number of teeth on each gears.
Also draw the structural diagram and speed chart.

OR

Q-5 **Attempt all questions**

(a) Describe the procedure of Johnson's method for optimum design with different forms of equations used. **(07)**

(b) A steel disc of 100 mm internal and 200 mm external radius is shrunk on an another steel disc of 20 mm internal diameter. Determine the change in the shrink fit pressure produced by inertia forces at 3600 rpm. **(07)**

Q-6 **Attempt all questions**

(a) What is the difference between stresses in thin and thick cylinders? When do you use Lame's equation for cylinder wall thickness? **(07)**

(b) Explain the design of an E.O.T. crane main girder (box type) based on strength and rigidity in detail. **(07)**

OR

Q-6 **Attempt all Questions**

(a) With a suitable example and explain the term "Robust Design". Also explain Tools used in robust design. **(07)**

(b) In light weight equipment, a shaft is transmitting a torque of 900 Nm and is to have a rigidity of 90 Nm/degree. Assume a factor of safety is 1.5 based on yield stress. Design the shaft with minimum weight. Assume maximum shear stress theory of failure. Use the following data for the materials: **(07)**

Material	Mass Density (kg/m3)	Yield Strength (MPa)	Shear Modulus (GPa)
M1	8500	130	80
M2	3000	50	26.7
M3	4800	90	40
M4	2100	20	16