C.U.SHAH UNIVERSITY
Winter Examination-2015

Subject Name: Advanced Machine Design

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

Semester: I   **Date: 29/12/2015**   **Time: 10.30 A.M. To 1.30 P.M**   **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**   **07**

   a. What is ethics in engineering design?
   b. Define the concept of plane state of strain.
   c. What is Miner's cumulative fatigue damage?
   d. State true and false giving Justification: A smaller rough area and large smooth area indicate small overload in fatigue fracture.
   e. Define quality loss function.
   f. What is preloaded bearing?
   g. Define friction and wear.

Q-2   **Attempt all questions**
   a. In reference to theories of failure discuss Von Mises criterion.   **03**
   b. Explain the concept of design for X (DFX) along with steps for implementing a DFX strategy   **05**
   c. A 80 mm long journal bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radial clearance of 0.05 mm and the viscosity of the oil is 0.021 kg / m-s at the operating temperature. If the bearing is capable of dissipating 80 J/s, determine the maximum safe speed.   **06**

OR

Q-2   **Attempt all questions**
   a. "Thin plate is tougher in comparison to thick plate", justify the statement with Reference to fracture mechanics.   **03**
   b. Explain application of Quality Function Deployment in Engineering Design.   **04**
   c. The state of stress at a point is characterized by the components σ_x=100 MPa, σ_y= - 40 MPa, σ_z=80 MPa and τ_{xy}= τ_{yz}= τ_{zx}= 0. Determine the extremum values   **07**

of the shear stresses, their associated normal stresses, the octahedral stress and its associated normal stress.

Q-3   **Attempt all questions**

     a. Discuss the basic objective of material handling system   **03**

     b. State and explain the following concept related to material handling equipment.   **04**
1 space utilization concept
2 unit load concept

     c. A mild steel bolt is subjected to a pull of 20 kN and transverse shear load of 10 kN. If σ_y=400 MPa and FOS=4, find the bolt diameter required according to 1. Maximum principal stress theory, 2.maximum shear stress theory, 3.Maximum strain energy theory.   **07**

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OR

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Q-3   **Attempt all questions**

     a. Explain the safe life and fail safe fatigue design criteria with suitable examples   **04**

     b. Discuss the different modes of lubrication with neat sketch.   **04**

     c. A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm^2.The corrected endurance limit stress for the machine component is 270 N/mm^2.The ultimate tensile strength and yield strength of the material are 600 and 450 N/mm^2 respectively. Find the factor of safety using 1. Gerber relation; 2. Goodman relation; and 3. Soderberg relation. Also find the factor of safety against static failure.   **06**

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SECTION – II

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Q-4   **Attempt the Following questions**   **07**

     a. Define "Brain storming

     b. What is optimum design for machine element?

     c. Define fatigue life of bearing

     d. Explain why less number of teeth is desirable but not practicable below a particular number?

     e. What is mechanical reliability?

     f. What is concurrent Engineering?

     g. Justify "The pinion is weaker than the gear made of same material."

Q-5   **Attempt all questions**

     a. State and explain the functions and requirements of spindle units and justify the same.   **04**

     b. A radial drilling machine using a gearbox is required to give 6 stepped speeds. Minimum speed =400 rpm, geometric progression ratio=1.25. The motor power is 10 kW at 1440 rpm. The power from motor to the input shaft of the gearbox is transmitted by v-belt drive, giving a speed reduction of 1.5:1. Determine,   **10**
1. Standard spindle speeds.
2. Draw the structural and speed diagram for the arrangement.
3. Determine number of teeth on each gear.
4. Draw the gear box layout.

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Q-5   **Attempt all questions**

     a. What is profile correction of gears? Explain characteristics of corrected gears.   **06**

b. A cylindrical torsion bar is required to transmit 60Kw at 600 rpm. **08**
The torsional stiffness is 100 N.m/degree. Using factor of safety
of 1.5, design the shaft for minimum weight. Use the following data
for the materials:

Material	Mass density N/mm^3	σ_y (MPa)	G (GPa)
St.Steel	0.11x10^{-3}	230	84
Titanium Alloy	0.06 x10^{-3}	910	42
Cr-Steel	0.1 x10^{-3}	420	84

Q-6 **Attempt all questions**
  a. Explain the spindle materials and its selection. **04**
  b. Discuss the recent advances in gear materials in detail. **04**
  c. A flat solid disc of uniform thickness has outer and inner diameter of 600 mm and **06**
100 mm respectively. It rotates at 3100 rpm. Find the maximum hoop and radial
stresses induced in it and the radius at which it occurs. Assume Density of disc
material, $\rho = 7400$ kg/m^3, $\mu = 0.3$, Modulus of elasticity, $E = 2$ x 10^5 N/mm^2.

OR

Q-6 **Attempt all Questions**
  a. With a suitable example explain the term 'Robust Design' **04**
  b. What do you understand by autofrettage and pre-stressing of thick cylinder? What **05**
are its advantages?
  c. During the turning operation on a work piece held between the centres, the **05**
tangential cutting force component was 150 kgf and radial -80 kgf. If the work
piece is 500 mm long and has diameter= 80 mm, determine the deflection when the
tool is 200 mm from the headstock. The headstock and tailstock stiffness is 35000,
15000 kgf/cm respectively