C.U.SHAH UNIVERSITY
Winter Examination-2015

Subject Name: Machine Design & Industrial Drafting

Subject Code: 4TE03MDI1   **Branch: B.Tech(Mechanical,Automobile)**

Semester: 3   Date: 10/12/2015   Time: 2.30 To 5.30   Marks: 70

Instructions:
  (1) Use of Programmable calculator & 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.

Q-1   **Attempt the following questions:**   **(14)**
  a) Gearbox is produced by
       (a) design by drawing   (b) design by craft evolution
       (c) design synthesis   (d) simultaneous design
  b) According to Indian standard, 50 H8-g7 means
       (a) upper limit is (50+8) mm and lower limit (50-7) mm
       (b) designation of tolerance with basic size 50 mm
       (c) designation of fit of two parts with basic size 50 mm
       (d) none of above
  c) The modulus of elasticity of carbon steel is
       (a) 207 000 N/mm^2 (b) 100 000 N/mm^2
       (c) 50 000 N/mm^2 (d) 80 000 N/mm^2
  d) Kennedy key is used in
       (a) light duty applications   (b) heavy duty applications
       (c) high speed applications   (d) precision equipments
  e) The joint between the piston rod and the cross head of steam engine is
       (a) knuckle joint   (b) universal joint
       (c) cotter joint   (d) key joint
  f) Polar coordinates are used mostly for drawing
       (a) Circle   (b) Arcs   (c) Vertical lines   (d) Angles Line
  g) For self locking screw
       (a) $\Phi > \alpha$ (b) $\alpha > \Phi$
       (c)$\mu < \tan \alpha$ (d) $\mu = \text{cosec } \alpha$
       where α = helix angle Φ= friction angle μ = coefficient of friction
  h) In static loading, the effect of stress concentration is more serious in case of
       (a) components made of brittle materials
       (b) components made of ductile materials
       (c) components made of brittle as well as ductile materials
   (d) none of the above

i) Does it matter which Hatch pattern you use in Section views?
(a) Yes   (b) No (c) Only if it is steel   (d) Sometimes

j) A washer is specified by
(a) outer diameter   (b) inner diameter
(c) thickness   (d) mean diameter

k) According to Unwin's formula, the relationship between the diameter of rivet (d) and thickness of cylinder wall (t) is
(a) $d = 5\sqrt{t}$ (b) $d = 6\sqrt{t}$
(c) $d = 1.6\sqrt{t}$ (d) $d = \sqrt{t}$

l) The angle of twist for a transmission shaft is inversely proportional to
(a) shaft diameter   (b) (shaft diameter)^2
(c) (shaft diameter)^3 (d) (shaft diameter)^4

m) A bushed-pin type flange coupling is used for
(a) for intersecting shafts   (b) when the shafts are not in exact alignment
(c) for parallel shafts   (d) small shafts rotating at slow speeds

n) Splines are used if,
(a) the power to be transmitted is high
(b) the torque to be transmitted is high
(c) the speed is high
(d) there is relative motion between shaft and hub

Attempt any four questions from Q-2 to Q-8

Q-2   **Attempt all questions**

a) Factor of safety and Selection of Material plays important role in Machine Design." Discuss   **03**

b) What is stress concentration? Suggest the different methods for reducing the stress concentration with the help of sketches.   **04**

c) A bolt of diameter d is enlarged near its head to a diameter D. The head is cylindrical having diameter D1 and thickness T as shown in Figure-1. The bolt when fixed in a structure having 6 mm plate thickness t , takes a tensile load of P=30 kN. Determine the dimensions d, D, D1 of the bolt using design stresses for the material of bolt as: Allowable tensile stress σ_t=60 MPa; Allowable shear stress τ=35 MPa; Allowable crushing stress σ_c= 50 MPa.   **07**
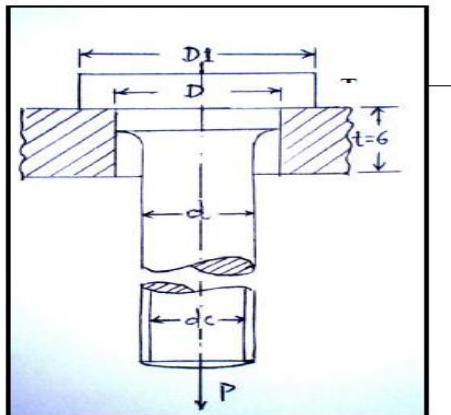
Q.2 (c) Figure-1

Q-3   **Attempt all questions**
a) Design a knuckle joint to transmit 50 kN. The design stresses may be taken as 80   **07**
MPa in tension, 40 MPa in shear and 80 MPa in compression

b) A double riveted lap jointed is to be made to join two plates 10 mm thick. The   **07**
design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 140 MPa
in crushing. Use chain riveting. Find rivet diameter, pitch of the rivet, transverse
pitch and efficiency of the joint.

Q-4   **Attempt all questions**
a) Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the   **08**
joint are made of the same material with the following allowable stresses: $\sigma_t = 60$
MPa ; $\tau = 70$ MPa ; and $\sigma_c = 125$ MPa.

b) What do you mean by eccentric loaded welded joint? Write the detail design   **06**
procedure for designing such a joint

Q-5   **Attempt all questions**
a) What is ASME code for shaft design?   **02**

b) What are different types of keys used to connect shaft to pulley or a gear?   **05**
Explain by drawing sketch and Compare the strengths of square key and
rectangular key.

c) Figure-2 shows a shaft carrying a pulley centrally between the bearings. The   **07**
weight of the pulley is 300 N, and belt tensions are 2000 N and 800 N on tight
and slack side of the vertical belt drive. The diameter of the pulley is 400 mm.
The shaft is made of 30C8 steel with $\sigma_{ut} = 500$ MPa and $\sigma_{yt} = 400$ MPa. Take
E= 2.1x 10^5 MPa, and Factor of safety is 1.5. Find the shaft diameter on the basis
of (i) Strength (ii) Torsional rigidity if permissible angle of twist is 0.7°.Take
G=80000 MPa

150   150
Weight
of pulley

T₁ 40° T₂
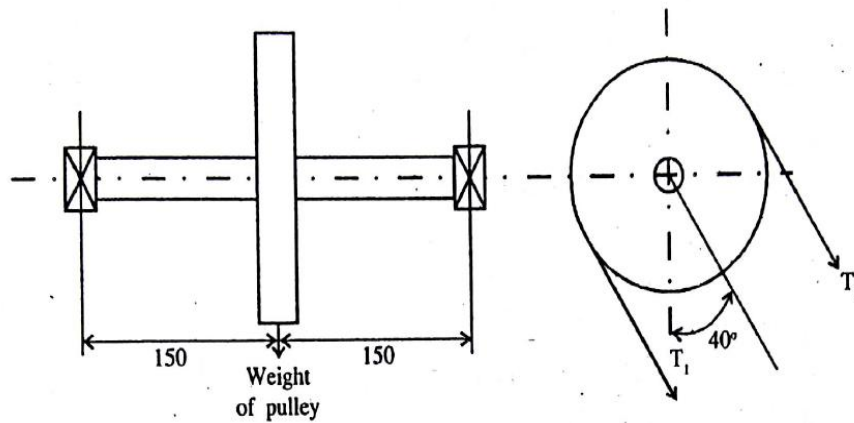
Q.5 (c) - Figure-2

Q-6   **Attempt all questions**
a) A power screw having double start square threads of 25 mm nominal diameter and 5   **07**
mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of
screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction
and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at
12 r.p.m. Assuming uniform wear condition at the collar and allowable thread

bearing pressure of 5.8 N/mm^2, find: 1. the torque required to rotate the screw; 2. the stress in the screw; and 3. the number of threads of nut in engagement with screw.

b) Draw a neat sketch of a protected type flanged coupling and write the design procedure with the design equations for different failure criteria. **07**

Q-7 **Attempt all questions**

a) What do you understand by self-locking and overhauling of screw? Show that the efficiency of self locking screws is less than 50 percent. **06**

b) Figure-3 shows a bench shearing machine to a shear round mild steel bar of 4 mm diameter. The ultimate shearing strength for mild steel is 320 MPa. The following permissible values of stresses may be used for pin and lever are: $\sigma t = 80$ MPa and $\tau = 45$ MPa ,Bearing pressure p_b=20 MPa for pins, find (i) Diameters of pins A,B,C,and D. (ii) cross-section of the lever –F if h=3t (iii) size of vertical link-E. **08**
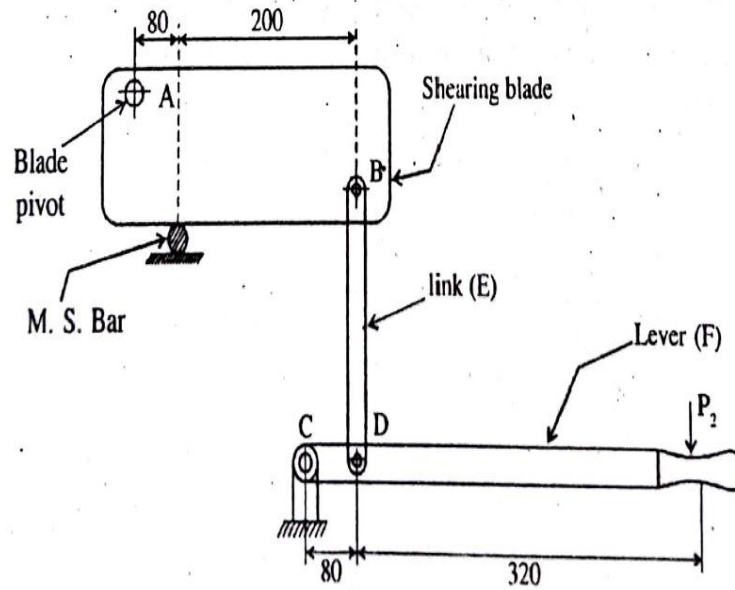
Q.7 (b) Figure-3

Q-8 **Attempt all questions**

a) What is surface roughness? How it is indicated on drawing? **03**
b) Explain Production Drawing & Assembly Drawing. **03**
c) Discuss the Indian standard system of fits. **04**
d) Explain the importance of Computer aided design and compare with conventional design. **04**