Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
400 level 1st Semester Examination – Jul. / Aug. 2016
SCT 415-2 Food Equipment Design and Fabrication

Uva Wellassa University

Instructions to candidates

Duration: (Two) hour

Number of questions: Four (04)

Mark allocation: 100

Answer all questions

1.

a. State the genaral design procedure that used to solve design problems in food equipment design (Explain each steps in the design procedure) . (10 Mark)

b. State and explain five important mechanical properties of material. (05 Mark)

c. The nature of fit is characterised by the presence and size of clearance and interference, fits are classified into three groups Explain them with suitable diagrams. (05 Mark)

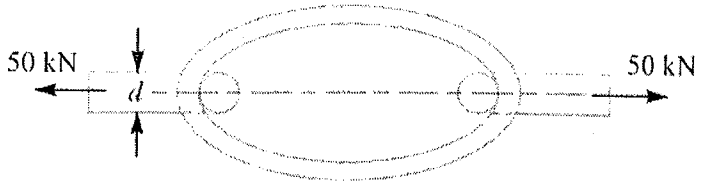
d. What do you understand by the nominal size and basic size? (05 Mark)

2.

a. In engineering practice, the machine parts are subjected to various forces, State reasons for occurrence of these forces? (05 Mark)

b. Draw the stress-strain diagram for a mild steel standard specimen under tensile test and explain the important important points and limits of the diagram. (10 Mark)

c. A coil chain of a crane required to carry a maximum load of 50 kN, is shown in figure. Find the diameter of the link stock, if the permissible tensile stress in the link material is not to exceed 75 MPa.



(10 Mark)

58

70

3.

a. A thin cylindrical pressure vessel of 500 mm diameter is subjected to an internal pressure of 2 N/mm^2. If the thickness of the vessel is 20 mm, find the hoop stress, longitudinal stress and the maximum shear stress. (10 Mark)

b. Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used : Shear stress for shaft, bolt and key material = 40 MPa, Crushing stress for bolt and key = 80 MPa, Shear stress for cast iron =8 MPa (15 Mark)

4.

a. What are the types of belts, Explain them with suitable diagrams. (05 Marks)

b. Show that in a cross belt drive, the total length of the belt (L) is given by,

$$L = \frac{\pi}{2}(d_1 + d_2) + 2x + \frac{(d_1 + d_2)^2}{4x}$$

Where, d_1, d_2 are diameters of larger and smaller pullys, x is the distance between the centers of the pullys. (10 Mark)

c. Two pulleys, one 450 mm diameter and the other 200 mm diameter, on parallel shafts 1.95 m apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley (10 Mark)

Some important formulas,

$$T = \frac{\pi}{16} \times \tau \times d^3 \; ; Solid\ shaft$$

$$T = \frac{\pi}{16} \times \tau \times \left(\frac{{d_o}^4 - {d_i}^4}{d_o}\right); Hollow\ shaft$$

$$T = \pi D \times t_f \times \tau_c \times \frac{\pi D^2}{2}; Flange$$

$$\sigma_h = p \times d/2t \; ; hoop\ stress$$

$$\sigma_l = p \times \frac{\pi}{4} \times d^2; longitudinal\ stress$$

$T =$ *Twisting moment (or torque)acting upon the shaft, Flange*
$\tau =$ *Torsional shear stress of shaft material*
$d =$ *diameter of the shaft*
$d_o =$ *External diameter of the shaft*
$d_i =$ *Internal diameter of the shaft*
$D =$ *Outer diameter of hub*
$\tau_c =$ *Torsional shear stress of flange material*
$t_f =$ *Thickness of flange*
$p =$ *Intensity of internal pressure*
$d =$ *Internal diameter of the cylindrical shell*
$l =$ *Length of the cylindrical shell*
$t =$ *Thickness of the cylindrical shell*
$\sigma_h =$ *Circumferential or hoop stress for the material of the cylindrical shell*
$\sigma_l =$ *longitudinal for the material of the cylindrical shell*

Proportions of standard parallel, tapered and gib head keys

Shaft diameter (mm)	*Key – Cross section*	
	Width (mm)	*Thickness (mm)*
6	2	2
8	3	3
10	4	4
12	5	5
17	6	6
22	8	7
30	10	8
38	12	8
44	14	9
50	18	10

Number of bolts for marine type flange coupling

Shaft diameter (mm)	35 to 55	56 to 150	151 to 230	231 to 390	Above 390
No. of bolts	4	6	8	10	12

The usual proportions for an unprotected type cast iron flange couplings, as shown in diagram below.

$$t_f = 0.5\ d$$