

B.E. (Mech) Part-II - 4th Semester Final Examination, 2013

Introduction to Mechanical Design (ME-401)

Full Marks.: 35

Time : 2 Hour

Use separate Answer script for each half
Attempt any two questions from each half
All the questions carry equal marks

First Half

1. (a) What do you understand by the term 'Mechanical Engineering Design'? Explain.
(b) Write down at least ten different design criteria.
(c) Write a short note on Factor of Safety.
2. (a) Define Stress concentration? Explain- the effect of stress concentration on machine elements with suitable diagrams.
(b) Explain- why the effect of stress concentration on a ductile material is not severe under static loading?
(c) Write a short note on Notch sensitivity.
3. (a) Draw a neat sketch of cotter joint with proper labeling
(b) Two rods are to be joined by a spigot and socket cotter joint to carry a load of 1 MN in tension. Design the joint. The material of all the elements of the joint is steel having following permissible stresses.
In tension 300 MPa, In crushing 450 MPa and In shear 275 MPa..

SECOND HALF

Full Marks: 35

**Attempt any Three questions.
All questions carry equal marks.**

1. (a) How do you classify Riveted joints? Briefly explain the various ways of failure of Riveted joints
(b) A triple riveted lap joint is to be made between 7.5 mm thick plates, having zig-zag riveting. Calculate the diameter, pitch and distance between rows of the rivets for the joint. Also find the efficiency of the joint. Take, $f_s = 75.0 \text{ MPa}$, $f_t = 100 \text{ MPa}$ and $f_c = 150 \text{ MPa}$. Symbols have their usual meaning.
2. (a) Explain the importance of Preferred Numbers.
(b) Find out the necessary expressions for the following of welded joints
 - (i) Tensile strength of Transverse fillet weld.
 - (ii) Shear strength of parallel fillet weld.
 - (iii) Maximum value of shear stress in a circular fillet weld under torsion.
3. (a) Deduce an expression for the maximum value of tensile stress developed in a fillet weld under bending.
(b) A cylindrical rod of 55 mm diameter is welded to a flat plate. The cylindrical fillet weld is loaded eccentrically by a force of 12 kN acting at a distance of 200 mm from the welded end. If the size of the weld is 25 mm, determine the maximum normal stress in the weld.
4. (a) Neglecting the effect of centrifugal force, find out the relation between tight side and slack side tensions in a flat belt drive.
(b) Design and select a flat-belt drive for a compressor running at 850 r.p.m.. The compressor is driven by a 40 kw, 1600 r.p.m. motor. The available space for the centre distance is 5m. The belt is open type and the belt velocity may be taken as 18m/s.

Use the following table to determine the arc of contact factor (F_d)

| Wrap angle(θ) in degree | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |
|-------------------------------------|------|------|------|------|------|------|------|------|------|
| F_d | 1.33 | 1.26 | 1.19 | 1.13 | 1.08 | 1.04 | 1.00 | 0.97 | 0.94 |

The standard widths of the belts (in mm.) are the following:

| | | | | | | | | | | |
|-------|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|
| 3-ply | 25 | 40 | 50 | 63 | 76 | | | | | |
| 4-ply | 40 | 44 | 50 | 63 | 76 | 90 | 100 | 112 | 125 | 152 |
| 5-ply | 76 | 100 | 112 | 125 | 152 | | | | | |
| 6-ply | 112 | 125 | 152 | 180 | 200 | | | | | |

5. Write short notes on any three of the following:

- (a) Length of belt in a Flat-belt (open) drive.
- (b) Advantages of welded joints over riveted joints.
- (c) Riveted Lap joints and Riveted Butt joints.
- (d) Tension (T_c) in a flat belt drive due to centrifugal force.