

GANPAT UNIVERSITY
B. TECH. SEM. VI MECHANICAL ENGINEERING
REGULAR EXAMINATION MAY/JUNE-2012
ME 605 DESIGN OF MACHINE ELEMENTS

[Time: 3 HOURS]

[TOTAL MARKS:70]

Instructions:

- (1) All questions are compulsory.
- (2) Right figure indicate full marks.
- (3) Assume suitable data if necessary.
- (4) Only scientific calculator is allowed.

SECTION-I**Que.1 Attempt the followings.**

- (a) What do you understand by slip of belt? [2]
- (b) What is simplex and duplex chain? [3]
- (c) A flat belt drive is used to drive a reciprocating compressor running at 720 rpm by a 15 kW, 1440 rpm electric motor. The required centre distance is 2 m. Select the flat belt for the drive. The power rating per mm width of the belt per ply at 180° arc of contact and 10 m/s belt speed is 0.023 kW. Load correction factor is 1.3. [7]
 Standard pulley diameters in mm are: 80, 90, 100, 112, 125, 140, 160, 180, 200, 224, 250, 280, 315, 355, 400, 450, 500, 560, 630, 710, 800, 900 and 1000.

OR**Que.1 Attempt the following.**

- (a) Write advantages of flat belt over v-belt. [2]
- (b) Sketch stress distribution in flat belt. [3]
- (c) Determine the percentage increase in power transmitting capacity made possible by changing over from a flat belt drive to a V-belt drive. The dia. of the flat pulley is the same as the pitch dia. of the grooved pulley. The flat pulley rotates at the same speed as the grooved pulley. The co-efficient of friction for the flat belt drive and the V-belt drive is same 0.3. The V-belt pulley groove angle is 60°. The belts are of the same material and have a same cross-sectional area. In each case the angle of wrap is 150°. [7]

Que.2 Attempt the followings.

- (a) Explain the significance of 'pv' values in the design of the brakes. [2]
- (b) Explain the parameters to be considered for the selection of friction lining for brakes. [4]
- (c) A single plate clutch, consisting of two pairs of contacting surfaces, is used to connect electric motor running at 1500 rpm with a machine. The machine is equivalent to a rotor of mass 200 kg and radius of gyration 300 mm. The inner and outer diameters of the contacting surfaces are 150 mm and 250 mm respectively. The coefficient of friction is 0.2 and the intensity of pressure is limited to 0.3 N/mm². The clutch is engaged suddenly so as to connect the stationery machine with the electric motor. Assuming the clutch as brand new, determine: [6]
 - (i) the power transmitting capacity of the clutch,
 - (ii) the time required by the machine to attain its full speed; and
 - (iii) the amount of heat generated during engagement.

OR

Que.2 Attempt the followings.

- Why clutches are usually designed on the basis of uniform wear condition? [1]
- Derive the expression for torque transmitting capacity of cone clutch considering uniform pressure condition. [4]
- A solid disk type cast iron flywheel of diameter 450 mm and width 90 mm is rotating at 1440 rpm. It is brought to rest by means of a brake in 1.5 seconds. The mass of brake drum assembly is 2.5 kg. The specific heat of cast iron brake is 460 J/kg°C. Assuming that the total heat generated is absorbed by the brake drum assembly, calculate: [6]
 - The temperature rise of the brake drum,
 - The braking torque capacity of the brake.

Que.3 Attempt the followings.

- Explain aesthetic considerations in design. [3]
- Explain following material designations: [4]
 - 30C8
 - FG150
 - 40Cr4Mo2
 - SAE 1010
- Explain manufacturing considerations for welding in design. [4]

SECTION - II

Que:4 Attempt following.

- How will you distinguish between static and fatigue failure. [3]
- Define dynamic stresses. Explain S-N diagram for ferrous materials and aluminium alloy. [4]
- A rectangular plate with a central hole is subjected to a completely reversed axial load of 20 kN as shown in figure-1. The notch sensitivity can be assumed as 0.8. Determine the plate thickness for infinite life, if the factor of safety is 2. Assume the ultimate tensile strength as 500 MPa. The surface factor is 0.8, size factor is 0.85 and the calculations are expected at 90% respectively for which the reliability factor is 0.897. The theoretical stress concentration factor may be taken as 2.5. [5]

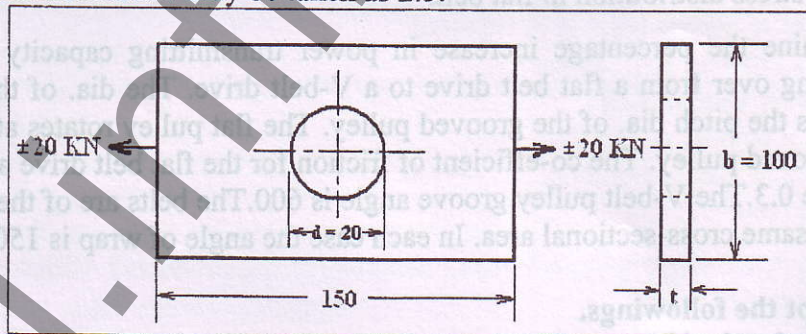


Fig.-1
OR

Que:4 Attempt following.

- Why endurance limit is modified? Enlist various factors for correcting endurance limit. [3]
- Define the terms theoretical stress concentration factor and fatigue stress concentration factor. Establish a relation between them. [4]
- A cantilever beam, shown in figure-2, of circular cross-section is fixed at one end and is subjected to a force P at the free end, which varies from -5 kN to +15 kN. The force is perpendicular to the axis of the beam. The distance between the free end and the critical section is 200 mm. The beam is made of cold drawn steel with ultimate tensile strength of 550 MPa and yield strength of 350 MPa. The theoretical stress concentration factor at the stepped end is 1.35 and the notch sensitivity is 0.85. The surface finish factor for the beam is 0.76 and the size factor can be taken as 0.85. The expected reliability is 90% and the reliability factor is 0.897. Assume a factor of safety as 2. Determine the cross-sectional diameter using Soderberg Criterion. [5]

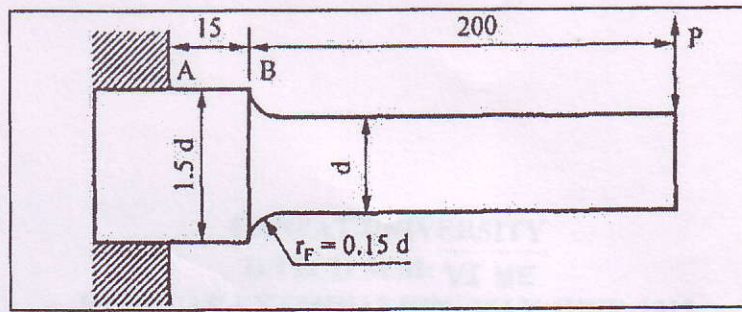


Fig-2

Que:5 Attempt following.

- Differentiate between thin and thick cylinders. State their applications. [2]
- What are the objectives of prestressing the high pressure cylinders? Enlist various methods of prestressing such cylinders and describe any one. [4]
- A seamless cylinder of is having storage capacity as 0.0245m^3 and it is made of alloy steel (20Mo55) is to be used to store a fluid at 14 MPa gauge pressure. Ultimate stress of the cylinder material is 450 N/mm^2 . The length of the cylinder is twice its inner diameter. If the factor of safety is 2.5, determine the cylinder dimensions. [6]

OR

Que:5 Attempt following.

- Sketch different welding symbols. [2]
- Describe the strength of parallel fillet welded joint. [4]
- A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld so that the maximum stress does not exceed 56 MPa. Consider the joint first to be under static loading and then under fatigue loading. [6]

Que:6 Attempt following.

- Explain: standardization and interchangeability. [3]
- A steel spindle transmits 4 kW at 800 rpm. The angular deflection should not exceed 0.25° per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, find the diameter of the spindle and the shear stress induced in the spindle. [4]
- It is required to standardize eleven shafts from 100 to 1000 mm diameter. Specify their diameters. [4]

Table – 1: Contact factor F_D

| Angle of wrap (deg) | 90 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 |
|---------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| F_D | 1.68 | 1.33 | 1.26 | 1.19 | 1.13 | 1.08 | 1.04 | 1.00 | 0.97 | 0.94 | 0.91 | 0.88 | 0.86 | 0.84 | 0.82 |

Table – 2: Standard belt widths

| No. of ply | Standard belt width in mm | | | | | |
|------------|---------------------------|-----|-----|-----|-----|--------------------|
| 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 | |

END OF PAPER