

GANPAT UNIVERSITY
B. Tech. Semester VI Mechanical Engineering
CBCS Regular Examination April – June 2017
2ME605 – Design of Machine Elements

Time: 3 Hours

Total marks: 60

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**

- (A) Explain adaptive design and new design with suitable example. [05]
 (B) State and illustrate various manufacturing considerations for design of welding. [05]

OR

Que.1

- (A) What is standardisation? Discuss its importance in design with suitable example. [05]
 (B) Explain the ergonomic considerations in the design of modern motorcycle. Comment on locations, sizes, types and arrangements of displays and controls. [05]

Que.2

- (A) What is dynamic stress? Explain different types of dynamic stresses with help of stress-time curves. [04]
 (B) A cantilever beam of circular cross-section is fixed at one end and subjected to completely reversed force of 10 kN at the free end. The force is perpendicular to the axis of the beam. The distance between free and fixed ends is 100 mm. the beam is made of steel with ultimate tensile strength of 540 N/mm^2 and tensile yield strength of 320 N/mm^2 . The construction of beam is such that there is no stress concentration. The size factor, surface finish factor and reliability factor are 0.85, 0.8 and 0.868 respectively. The operating temperature is 50°C for which the temperature factor is 1.010. If the diameter of the beam is 35 mm, determine life of the beam. [06]

OR

Que.2

- (A) Explain by sketches the thin cylinder, thick cylinder and thin spherical vessels with their stresses produced in it. [04]
 (B) An air receiver consisting of a cylinder closed by hemispherical ends is shown in figure – 1. It has a storage capacity of 0.25 m^3 and an operating internal pressure of 5 MPa. It is made of plain carbon steel 10C4 ($\sigma_{ut} = 340 \text{ N/mm}^2$) and the factor of safety is 4. Neglecting the effect of welded joint, determine the dimensions of the receiver. [06]

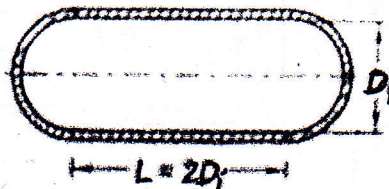


Fig. – 1

Que.3

- (A) What is stress concentration? Explain its effect in fatigue loading. Also explain method of reducing the effects of stress concentration. [04]
- (B) A component machined from a plate made of steel 45C8 ($\sigma_{ut} = 550 \text{ N/mm}^2$) is shown in figure - 2. It is subjected to a completely reversed axial force of 50 kN. The expected reliability is 90% for which the reliability factor is 0.897 and the factor of safety is 2. Surface finish factor and size factor are 0.76 and 0.85 respectively. Determine the plate thickness 't' for infinite life, if the notch sensitivity factor is 0.8. Take theoretical stress concentration factor as 2.27. [06]

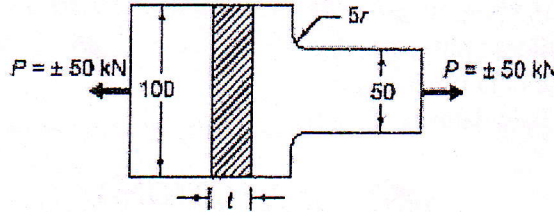


Fig. - 2

SECTION - II

Que:4

- (A) A compressor requiring 30 kW, is to run at about 450 rpm. The drive is by V- Belts from an electric motor running at 1000 rpm. The diameter of the pulley on the compressor shaft must not greater than 1 meter while the centre distance between the pulleys is limited to 1.75 meter. The belt speed should not exceed 1600 m/min. If each belt has a cross sectional area of 375 mm^2 , density 1000 kg/m^3 and an allowable tensile stress of 2.5 MPa, determine the number of V - belts required to transmit the power. The groove angle of the pulley is 35° . The Coefficient of friction between the belt and pulley is 0.35. Also calculate the length required of each belt. [07]
- (B) In open belt drive, which side of the belt is tight, whether upper side or lower side? Why? [03]

OR

Que:4

- (A) A belt 100 mm wide and 10 mm thick is transmitting power at 1000 m/min. The net driving tension is 1.8 time the tension on the slack side. If the safe permissible stress on the belt section is 1.6 MPa, calculate the maximum power that can be transmitted at this speed. Assume density of leather as 1000 kg/m^3 . Calculate the absolute maximum power that can be transmitted by this belt and the speed at which this can be transmitted. [07]
- (B) Explain any three types of belt drives with neat sketch. [03]

Que:5

- (A) A welded construction, as shown in figure - 3, is subjected to an eccentric force 7.5 kN. Determine the size of welds if the permissible shear stress for the weld is 100 N/mm^2 . Assume static conditions. [07]

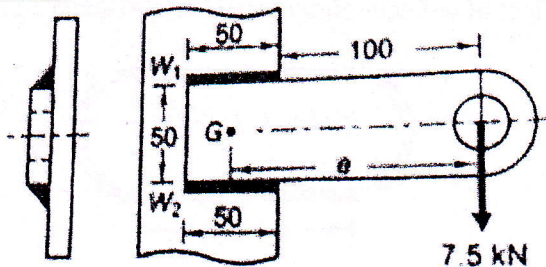


Fig. - 3

(B) Write advantages and disadvantages of Weld Joint over Riveted Joint. [03]

OR

Que:5

(A) An automobile single clutch consists of two pairs of contacting surfaces with an asbestos friction lining. The torque transmitting capacity of the clutch is 300 N.m. The coefficient of friction is 0.25 and the permissible intensity of pressure is 0.4 N/mm^2 . Due to space limitations, the outer diameter of the friction disk is fixed as 240 mm. Using the uniform wear theory, calculate the inner diameter of the friction disk and the spring force required to keep the clutch in engaged position. [06]

(B) Explain advantage and limitation of Cone clutches. [02]

(C) Explain characteristic of friction clutch material. [02]

Que:6

[A] A single block brake with a braking torque capacity of 225 N.m is shown in figure - 4. The brake drum rotates at 500 rpm and coefficient of friction between the brake drum and the block is 0.3. The permissible intensity of pressure between the brake drum and the block is 0.5 N/mm^2 . Calculate : [07]

1. The actuating force and the hinge pin reaction for clockwise rotation of the drum;
2. The actuating force and the hinge pin reaction for anti-clockwise rotation of the drum;
3. The dimensions of the block;
4. The dimension 'c' required for brake to be self-locking and
5. The rate of heat generated at the beginning of the brake.

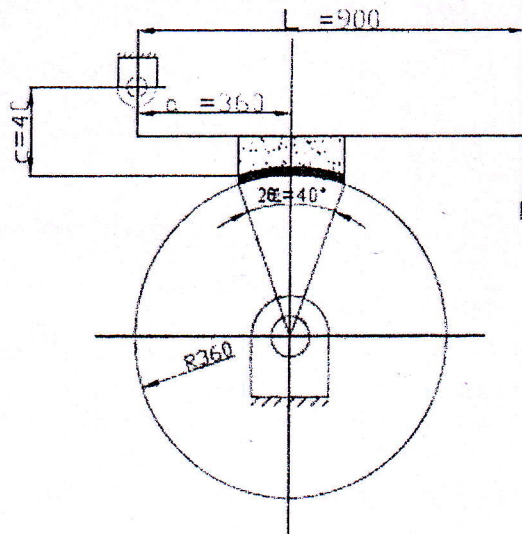


Fig. - 4

[B] Explain the parameters to be considered for the selection of friction lining for brake. [03]

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