

GUJARAT UNIVERSITY

B.E. Sem. VII (Mech.) (Old) Examination

Machine Design-I

Saturday, 29th December, 2007]

[Time : 4 Hours

Max. Marks : 100

- Instructions :
- (1) Attempt all questions.
 - (2) Answer to the two sections must be written in separate answer books.
 - (3) Assume additional data if necessary.
 - (4) Draw neat sketch, wherever necessary.
 - (5) Figures to the right indicate full marks.
 - (6) Use standard data if required.

SECTION I

1. Attempt any four

(a) Explain preferred number. Derive the preferred no numbers of R5 and R20 series

(b) Define & explain following

(i) Tolerance

(ii) Deviation

(iii) Fits

(iv) Limit system

(c) Give advantages of welding over other metal fabrication process

(d) Explain human consideration in machine

design
(e) Explain standardisation and interchangeability.

[P.T.O.]

(16)

2 (a) A single plate ^{D-2} clutch is to be designed for transmission of 15 kW at 4000 rpm. Both the side of plate having friction lining ($\mu = 0.35$). The axial force is provided by 6 springs (compression). The permissible pressure is 0.15 MPa. The ratio of plate diameter is to be 1.5. Determine the size of friction plate and the load on each spring. Sketch the assembly showing the method of operating the clutch.

(b) State the design considerations made in clutch design and write down the selection criteria for clutch in engineering field.

OR

2 (a) State detail classification of brake and the important factor to be considered while designing brake.

(b) Design the band brake from data given below

Braking torque = 2500 Nm, Speed of drum = 200 rpm

Arc of contact = 250° , Coefficient of friction lining to drum = 0.25

Drum diameter = 50 cm. Arm of applied force = 100 cm.

Distance of tight side from pivot point = 5 cm. Distance from of slack side from pivot point = 70 cm.

Allowable tensile stress for lever, pin, band & rivet = 80 N/mm²

Estimate (i) Dimension for band, lever, pins and drum

(ii) kW absorbed by brake

- V G
- 1. State the advantage and dis-advantages (16)
 - 2. Flat drive over belt & rope drive
 - 3. Determine the belt size and design
 - 4. Draw C-I pulley for flat belt drive
 - 5. Motor power = 5.8 kW, speed of motor = 1500 rpm, speed of driven pulley = 450 rpm
 - 6. Minimum peripheral speed of belt = 16 m/sec
 - 7. Idler factor = 1.2
 - 8. Density of leather belt = 0.98 gm/cc
 - 9. Diameter of pulley (smaller) to thickness
 - 10. Coefficient of friction = 0.35
 - 11. Ultimate strength limit for belt material = 40 kg/cm²
 - 12. Modulus of rupture elasticity = 1000 kg/cm²
 - 13. Factor of safety = 10
 - 14. Ultimate strength of belt = 250 kg/cm²
 - 15. Centre distance = 280 cm

OR

- 1. Sketch the cross section of V belt (16)
- 2. Label its parts. How the V belts are fixed
- 3. Two shafts whose centres are 1 metre apart are connected by V-belt drive.
- 4. Driven pulley is supplied with power and has an effective diameter of 300 mm. It runs at 1000 rpm. The drive pulley runs at 375 rpm. The angle of groove on pulleys is 40°. The permissible tension per cross sectional area belt is 2.1 MPa.
- 5. Density of belt is 1100 kg/m³.
- 6. Drive pulley is over hung, the distance from nearest bearing 200 mm.
- 7. Coefficient of friction between the belt and pulley is 0.28.

- 8. Number of belt required
- 9. Torque of driven pulley shaft if
- 10. Shear stress is 42 MPa

(3)

(P.T.O)

- 4 (a) What is fatigue loading
 (b) What is endurance strength and endurance limit.
 (c) Give S-N curve and explain it in connection with fatigue loading.
 (d) Determine the thickness of 120 mm wide uniform plate for safe continuous operation for maximum and minimum tensile load of 25000 N and 10000 N respectively. Properties of plate material are as follows. Endurance limit stress = 2.25 N/mm^2 . Yield stress = 3 N/mm^2 . Factor of safety = 1.5

- 5 (a) What is self locking property of power screw? Where it is necessary? Where it is not necessary?

(b) Explain the design equation for designing a lever nut and screw of screw jack.

(c) Design screw press from the following specification

Load = 50 kN Efficiency = 15%

Screw = M 38 x 8 coarse square threads

Thread to bearing stress = 13.5 MPa

Column action may be taken into account by increasing load by 10%

Nut is provided with a collar to support it on press body

Screw - C-30 steel $\sigma_u = 600 \text{ MPa}$

$\sigma_t = 80 \text{ MPa}$

$\tau = 45 \text{ MPa}$

Nut CI Gr-20 $\sigma_t = 18 \text{ MPa}$

$\sigma_c = 120 \text{ MPa}$

OR

- 5 (a) Select power thread for following applications (16)

(i) Lead screw (ii) Toggle jack (iii) Machine vice (iv) Lock gate

(b) A machine slide weighing 5 kN is elevated by double start screw at rate of 0.84 m/min

If coefficient of friction for thread is 0.12

and that for collar is 0.14. Calculate the power

to give slide. The end of screw carries a thrust

bearing of 32 mm inside and 58 mm outside

diameter. Pitch = 7 mm Nominal dia. of screw

is 44 mm. If the screw material is C-45, is it

strong enough to sustain the load?

D=5

6 (a) Name thin and thick walled pressure vessel (3)

(three in each type)

(b) Show the distribution of hoop stress and radial stress for thick walled cylinder subjected to internal pressure (3)

(c) How will you differentiate between a thick cylinder and thin cylinder (2)

(d) A C.I. pipe is required to handle 140 k lit/hr water under pressure of 1.8 MPa and flow rate is 15.2 m/min. Determine the pipe diameter and its thickness for an allowable stress of 20 MPa. Rounding and casting allowance may be taken as 9mm, Join efficiency is 90%. (8)

OR

6 (a) State the various formula used in determining the thickness of thick cylinder state where will you use a particular formula stating reason there of? (4)

(b) A mechanism is operated (12)

(c) Design a C.I. cylinder and flange from following data

(i) Inner diameter of cylinder = 300mm

(ii) Safe stress for cylinder = ~~12 N/mm²~~

(iii) Safe stress for cover material = 12 N/mm²

(iv) Internal fluid pressure = 1 N/mm²

(v) Safe stress for bolt material = 50 N/mm²

Calculate

(i) Thickness of cylinder wall

(ii) Thickness of flange

(iii) Thickness of cover

(iv) Size and number of bolts.

—X—X—