Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: VI Mechanical Engineering

CBCS Regular Examination May – June 2014

2ME605 Design of Machine Elements

Time: 3 Hours **Total Marks: 70**

Instructions: (1) Attempt all questions.
(2) Assume suitable data if necessary.
(3) Right Figure indicates full marks.

Section – I

Que. – 1 Attempt the following questions.

(A) Derive the equation of torque transmitting capacity for single plate clutch using both cases. **(05)**

(B) A plate clutch three disc on the driving shaft and two discs on the driven shaft providing four pair of contact surface. The outside diameter of the contact surface is 240 mm and inside diameter 120 mm. Assuming co-efficient of friction is 0.3. Find the total spring load pressing. The plates together to transmit 25 kw at 1575 rpm. **(07)**

If there are 6 springs each of stiffness 13kN/m and each of the contact surfaces has worn away by 1.25 mm. Find the maximum power that can be transmitted. Assuming uniform wear.

OR

Que. – 1 Attempt the following questions.

(A) Derive the equation of torque transmitting capacity for cone clutch using all possible approaches. **(05)**

(B) A multi plate clutch of alternate bronze and steel plates is to transmit 6 kW power at 800 rpm. The inner radius is 38 mm and outer radius is 70 mm. The coefficient of friction is 0.1 and maximum allowable pressure is 350 kN /m^2 determine **(07)**

(1) Axial force required
(2) Total number of discs
(3) Average pressure and
(4) Actual maximum pressure

Que. – 2 Attempt the following questions.

(A) Explain simple Band brake with its applications. **(05)**

(B) In a simple band brake as show in **Fig. (A)**, the length of lever is 440 mm. The tight end of the band is attached to the fulcrum of the lever and the slack end to a pin 50 mm from the fulcrum. The diameter of the brake drum is 1 m and the arc of contact is 300°. The coefficient of friction between the band and the drum is 0.35. The brake drum is attached to a hoisting drum of diameter 0.65 m that sustains a load of 20 kN. Determine: **(06)**

(1) Force required at the end of lever to just support the load.
(2) Required force when the direction of rotation is reversed.
(3) Width of steel band if the tensile stress is limited to 50 N/mm^2

OR

Que. – 2 Attempt the following questions.

(A) Derive the equation of braking torque for single shoe brake. (05)

(B) The layout of a brake to be rated at 250 N-m at 600 rpm is shown in Fig. (B). The drum diameter is 200 mm and the angle of contact of each shoe is 120°. The coefficient of friction may be assumed as 0.3 Determine. (06)

(1) Spring force F required to set the brake.

(2) Width of the shoe if the value of pv is 2 N-m/mm^2-sec

Que. – 3 Attempt any THREE. (12)

(A) Explain centrifugal clutch with neat sketch.

(B) Explain lame's Equation for thick cylinder subjected to an internal pressure.

(C) Explain the following related to thick cylinder type pressure vessel.

(D) Explain disc brake with neat sketch.

Section – II

Que. – 4 Attempt the following questions.

(A) What is stress concentration? What are the causes of stress concentration? Explain with diagrams, methods for reduction of stress concentration. (05)

(B) A Polished steel bar as shown in Fig. (C) is subjected to axial tensile force that varies from zero to P_{max}. It has groove 2 mm deep and having a radius of 3 mm. The theoretical stress concentration and notch sensitivity factor at the groove are 1.8 and 0.95 respectively. The outer diameter of the bar is 30 mm. The ultimate tensile strength of bar is 1250 MPa. The endurance limit in reverse bending is 600 MPa. Find the maximum force that the bar can carry for 10^5 cycles with 90% reliability. Take surface finish factor 1. (07)

OR

Que. – 4 Attempt the following questions.

(A) Explain endurance limit and notch sensitivity. (05)

(B) A rectangular plate with centre hole is subjected to completely reverse axial load of 20 KN as shown in Fig. (D). 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 calculation is expected at 90% reliability, for which the reliability factor is 0.897. The theoretical stress concentration is 2.5. (07)

Que. – 5 Attempt the following questions.

(A) Explain the equation to find the length of open and cross belt drive? (05)

(B) A V-belt drive is used to transmit 30 kW power from electric motor running at 1440 rpm to a machine running at 480 rpm. The centre distance between the input and output shaft is 1m. The pulley in groove angle is 38° and the μ between belt and pulley is 0.2. The density of belt material is 1000 kg/m^3 and the allowable tensile stress for the belt is 1.53 N/mm^2. The cross sectional dimension of the V-belt are (06)

Width of the belt at top =37 mm

Width of the belt at bottom = 19 mm

Depth of the belt = 25 mm

Find:

(1) The minimum number of belt required and

(2) The pulley diameter

OR

Que. – 5 Attempt the following questions.

(A) Derive the condition for transmission of maximum power with all possible approaches? **(05)**

(B) A cross belt arrangement has centre distance between pulleys as 1500 mm .The small pulley rotates at 1000 rpm and the bigger pulleys rotate at 500 rpm. The flat belt used is 6 mm thick and transmits 7.5Kw power at belt speed of 13m/s approximately. The co efficient of friction is 0.3 and the density of the belt material is 950 kg/m^3. If the permissible tensile stress for the belt is not to exceed 1.75N/mm^2, calculate. **(06)**

(1) diameter of the pulleys,
(2) length and width of the belt ,and
(3) Initial tension required in belts.

Que. – 6 Attempt any THREE. **(12)**

(A) What is design of machine element? Explain the phase of machine design.

(B) Explain reliability factor also explain cumulative damage in fatigue.

(C) Derive the equation of belt tension ratio for flat belt drive?

(D) Explain types of welding positions.

Figures:-

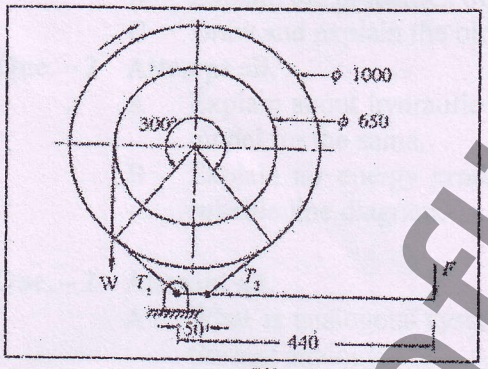

Fig. (A)

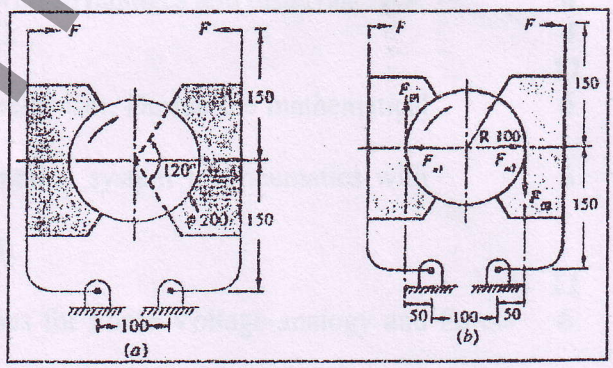

Fig. (B)

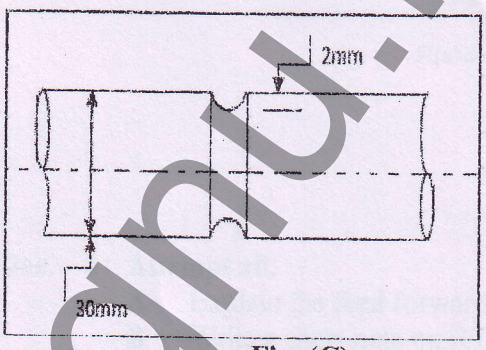

Fig. (C)

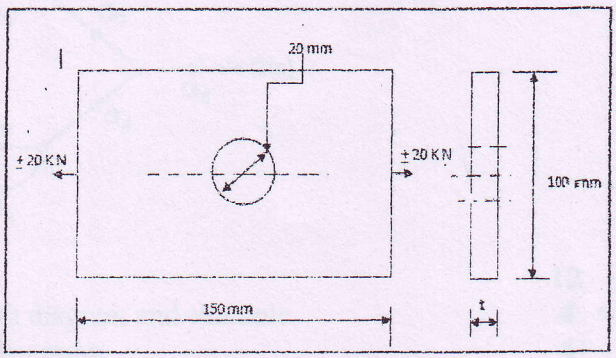

Fig. (D)

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