Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: VI (Mechanical) Engineering

Regular Examination April – June 2016

2ME605 – Design of Machine Elements

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

Instruction: 1 This Question paper has two sections. Attempt each section in separate answer book.
2 Figures on right indicate marks.
3 Be precise and to the point in answering the descriptive questions.
4 Assume any suitable data if necessary.

Section – 1

Que.–1

(A) What are the materials used for lining of friction surfaces of friction clutches? [02]

(B) Establish a formula for the frictional torque transmitted by a cone clutch. [04]

(C) A multiplate clutch is used to transmit 5 kW power at 1440 rpm. The inner and outer diameters of contacting surfaces are 50 mm and 80 mm respectively. The coefficient of friction and the average allowable pressure intensity for the lining may be assumed as 0.10 and 350 kPa respectively. Determine: [06]
(i) Number of friction plates and pressure plates,
(ii) Axial force required to transmit power,
(iii) The actual average pressure, and
(iv) Actual maximum pressure intensity after wear.

OR

Que.–1

(A) Why is it necessary to dissipate the heat generated when clutches operate? [02]

(B) Derive an expression for torque capacity of plate clutches. [04]

(C) A cone clutch with asbestos friction lining is used to transmit 30 kW power at 1440 rpm. The coefficient of friction between the contacting surfaces is 0.2 while the permissible intensity of pressure is 0.35 N/mm^2. The semi-cone angle is 12.5°. The mean radius of the friction surface is twice the face width. Assuming the uniform pressure condition, determine: [06]
(i) The dimensions of the friction surface; and
(ii) The axial force required to engage the clutch.

Que.–2

(A) What is the pressure vessel? How do you distinguish between the thick and thin cylinders? [04]

(B) The hydraulic cylinder 400 mm bore operates at a maximum pressure of 5 N/mm^2. The piston rod is connected to the load and the cylinder to be framed through hinged joints. Design: (i) cylinder, (ii) piston rod, (iii) hinge pin and (iv) flat end cover. [07]
The allowable tensile stress for cast steel cylinder and end cover is 80 MPa and for piston rod is 60 MPa. The allowable shear stress for hinge pin material is 45 MPa.

OR

Que.–2

(A) What is self-energizing brake? [02]

(B) Derive a relation for determining the frictional braking torque of caliper disc brake. [03]

(C) A car requires disk brakes for the front wheels. Braking is affected by two annular pads per wheel. The inner radius of the pad is 125 mm and the outer radius is 165 mm. The pad subtends an angle of 90° at the centre of disk. The friction material has a coefficient of friction of 0.3. Each front wheel brake requires a torque of 2000 N·m. Determine the maximum, minimum and average intensity of pressure. [06]

Que.–3

(A) What is standardization and interchangeability? Explain their importance in design. [04]

(B) Explain the significance of ergonomic considerations in machine design. [04]

(C) Write brief note on the design considerations of casting. [04]

Section – II

Que.–4

(A) Two Pulleys, one 450 mm diameter and the other 200 mm diameter on parallel shafts 1.95 m apart are connected by crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rpm, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? [06]

(B) Derive the condition for the transmission of maximum power in belt drive. [04]

(C) Explain centrifugal tension and also explain its effect on power transmission. [02]

OR

Que.–4

(A) A flat belt is required to transmit 15 kW from a pulley of 1.2 m effective diameter running at 450 rpm. The angle of contact is spread over $11/24^{th}$ of the circumference. The coefficient of friction between the belt and pulley surface is 0.3. Determine, taking centrifugal tension into account, width of belt required. It is given that the belt thickness is 9.5 mm, density of its material is 1050 kg/m^3 and the related permissible working stress is 2.3 MPa. [06]

(B) Enlist and explain different types of belt drive. [04]

(C) Explain construction details of the belt. [02]

Que.–5

(A) A bar of circular cross section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using factor of safety 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. [07]

(B) Explain stress Concentration. How its effect can be reduced? [04]

OR

Que.–5

(A) Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows: Endurance limit stress – 225 MPa and Yield point stress – 300 MPa. The factor of safety based on yield point may be taken as 1.5. [07]

(B) Explain fatigue stress concentration factor and notch sensitivity. [04]

Que.–6

(A) Explain Goodman criteria and Derive equation for Factor of safety. [04]

(B) Discuss the standard location of elements of a welding symbol. [04]

(C) A 50 mm diameter solid shaft is welded to a flat plate as shown in fig.-1. If the size of weld is 50 mm, find the maximum normal and shear stress in the weld. [04]

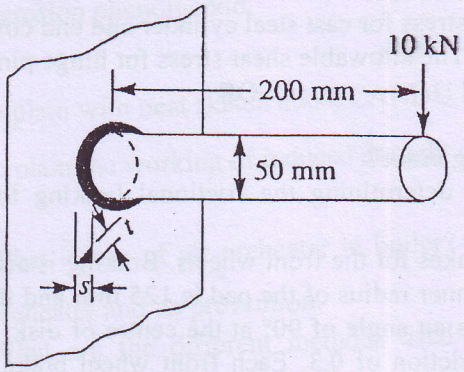

Fig.-1

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