Student Exam No:_____

GANPAT UNIVERSITY
B. TECH. SEM- V (MC) REGULAR EXAMINATION- NOV - DEC 2016
2MC501 – 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) What are the causes of stress concentration? [02]

(B) What are the factors that affect endurance limit of machine part? [02]

(C) A cantilever beam of circular cross section, made of cold drawn steel having ultimate tensile strength of 550 N/mm^2, is fixed at one end and is subjected to completely reversed force of 15 kN at the free end. The force is perpendicular to the axis of the beam. The distance between the fixed and free end of the cantilever beam is 200 mm. the theoretical stress concentration factor and the notch sensitivity at the fixed end are 1.35 and 0.85 respectively. The surface finish factor for the beam is 0.80. The expected reliability is 90% and the reliability factor is 0.897. The values of size factor are as follows. [06]

Diameter, d in mm	Size factor
$d \leq 7.5$	1.00
$7.5 < d \leq 50$	0.85
$d > 50$	0.75

OR

Que.1

(A) Define endurance limit and dynamic stress. [02]

(B) What is physical significance of notch sensitivity factor being 1 and 0? [02]

(C) A cantilever beam of circular cross section is fixed at one end and is subjected to completely reversed force of 100 kN at the free end. The force is perpendicular to the axis of the beam. The distance between the fixed and free end of the cantilever beam is 400 mm. There is no stress concentration. The beam is made of steel with an ultimate tensile strength of 1300 MPa. The surface finish factor for the beam is 0.87 and the size factor is 0.85. The reliability factor is 0.868. Determine the diameter of the beam for a life of 47500 cycles. [06]

Que.2

(A) Derive the equation for ratio of limiting tension for V-belt. [04]

(B) An open belt connects two flat pulleys. The pulley diameters are 300 mm and 450 mm and the corresponding angles of lap are 150° and 220°. The smaller pulley runs at 240 rpm. The coefficient of friction between the belt and pulley is 0.25. It is found the belt is on the point of slipping when 3 kW is transmitted. To increase the power transmitted two alternatives are suggested namely (i) increasing the initial tension by 10%, and (ii) increasing the coefficient of friction by 10% by the application of a suitable dressing to a belt. Which of these two methods would be more effective? Find the increase in power possible in each case. [06]

OR

Que.2

(A) Write the procedure to select flat and V belt from manufacturer's catalogue. [04]

(B) A single V-belt is used to transmit power from a grooved pulley of pitch diameter 200 [06]

mm running at 1500 rpm to a flat pulley of a diameter 600 mm. The center distance between the pulleys is 1000 mm. The mass of the belt is 0.3 kg/m. The coefficient of friction between belt and pulley is 0.25. The V-belt pulley groove angle is 38°. If the allowable tension in the belt is 800 N. Determine: (i) the power transmitting capacity of the belt, and (ii) the initial tension required in the belt.

Que.3 Attempt any TWO. [10]

(A) Explain different types of dynamic stresses with neat sketches.
(B) Write brief note on manufacturing considerations of casting in design.
(C) Enlist general considerations in machine design.

SECTION – II

Que:4

(A) What is self-actuating or self-energizing brake? When a brake becomes self-locking? [04]
(B) A pivoted double block brake has two shoes each of which subtend an angle of 120° at the center of the brake drum. The diameter of the brake drum is 450 mm and width of the friction lining is 75 mm. The coefficient of friction is 0.2 and the maximum intensity of pressure between the lining and brake drum is 0.5 N/mm^2. The pivot of each shoe is located in such manner that moment of frictional force on the shoe is zero. Assuming that the same actuating force is applied on both shoes. Find: (i) The distance of the pivot from the axis of the drum (ii) The braking torque capacity of the brake and, (iii) The pivot reactions. [06]

OR

Que:4

(A) What is the drawback of a single shoe brake? How do you overcome this? [04]
(B) A car having a mass of 650 kg and traveling at a speed 90 km/hr is brought to the rest by applying the brakes on all four wheels. The car decelerates at a rate of 6.2 m/s every second and the mass moment of inertia of each wheel about the axis of rotation is 0.45 kg-m^2. The rolling radius of the wheel is 200 mm. The rotating and reciprocating parts of the engine and transmission system are equivalent to a mass moment of inertia of 2.5 kg-m^2 at five times the wheel speed. Calculate: (i) The energy absorbed by each brake, (ii) The braking torque capacity of each brake. [06]

Que:5

(A) Derive the equation of torque transmitting capacity for wet clutch. (For both case) [04]
(B) A multi-plate clutch is used to transmit 5 kW power at 1500 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 0.15 and 320 kPa respectively. Determine, (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. [06]

OR

Que:5

(A) Find the optimum diameter ratio for torque transmission capacity of plate clutch. [04]
(B) A cone clutch has a cone angle of 23°. If the intensity of pressure between contact surfaces is 0.35 MPa and the breadth of the conical surface is not to exceed one third of mean radius, find the dimensions of the contact surface to transmit 40 kW at 220 rpm, assume uniform wear theory and the coefficient of friction between contact surfaces as 0.25. [06]

Que:6 Attempt any TWO. [10]

(A) Write the procedure of design of shaft based on rigidity.
(B) Explain working of centrifugal clutch with sketch.
(C) Classify the brakes. Also write what are the different energies absorbed by a brake system, in a hoisting machinery?

END OF PAPER