TE / I / Mech / Theory of Machines - II

Con. 3754–12. 18.05.12 GN–6905

(3 Hours) [Total Marks : 100

N.B. 1) Question No.1 is compulsory.
2) Attempt any four questions out of the remaining six questions.
3) Figures to the right indicate full marks.
4) Assume suitable data wherever required but justify the same.

1. Solve any four : (20)

1) The inner and the outer radii of a single plate clutch are 40 mm and 80 mm respectively. Determine the maximum, minimum and the average pressure when the axial force is 3 KN.
2) A bicycle and rider, travelling at 12 km/hr on a level road, have a mass of 105 kg. A brake is applied to the rear wheel which is 800 mm in diameter. The pressure on the brake is 80 N and the coefficient of friction is 0.06. Find the distance covered by the bicycle and number of turns of its wheel before coming to rest.
3) In a spring loaded Hartnell governor, the extreme radii of rotation of the balls are 80 mm and 120 mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 and 420 rpm, find the initial compression of the central spring.
4) An aeroplane makes a half circle of 100 m radius, towards left when flying at 400 km/hr. The engine and propeller of plane weights 500 kg and has a radius of gyration of 30 cm. The engine rotates at 3000 rpm anticlockwise, when viewed from front end. Find the gyroscopic couple.
5) In a compound train of wheels the drivers have 30, 60, 90 and 120 teeth and the followers have 12, 40, 50 and 80 teeth. If the driving shaft rotates at 120 rpm, find the speed of the driven shaft.

2. 1) 100 KW is transmitted at 3000 rpm by a multiple disc friction clutch. The plates are having friction surface with coefficient as 0.07 and the axial intensity of pressure is not to exceed 1.5 bar. External radius is 1.25 times the internal radius and the external radius is 12.5 cm. Determine the number of plates needed to transmit the required torque assuming uniform wear. (10)

2) A porter governor has rotating masses 5 kg each and mass of the sleeve is 30 kg. Upper links are 25 cm long and lower links are 35 cm long. The upper ends of the upper links and lower ends of the lower links are hinged at 4 cm from the shaft axis. Find the equilibrium speed of the governor in rpm when the governor weights rotate at 130 mm radius. Also find the governor effort and governor power if there is sudden change of 1 % in speed of the governor. (10)

3. 1) Describe with a neat sketch a centrifugal clutch and deduce an equation for the total torque transmitted. (10)

2) A two wheeler motor vehicle and its rider weigh 130 kg and their combined C.G. is 750 mm above the ground level when the vehicle is upright. Each road wheel is 600 mm diameter and has M.I. of 1.2 kg-m^2 about its axis of rotation. The rotating parts of the engine have M.I. of 0.4 kg-m^2. The engine rotates at 5 times the speed of the road wheels and in the same sense. When the vehicle is rounding the curve of 130 m radius at a speed of 60 km/hr. Determine i) magnitude of total gyroscopic couple acting on the vehicle and ii) angle of banking so that there will be no tendency of side slip. (10)

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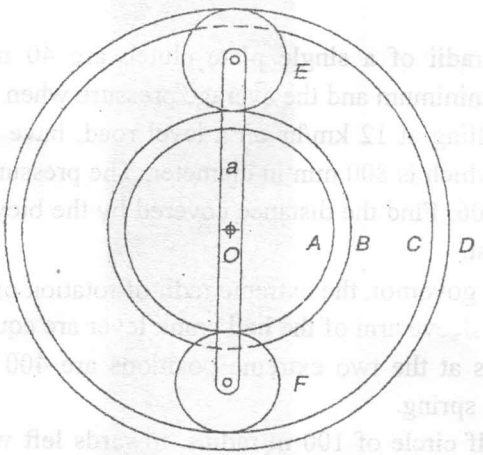
4. 1) In the epicyclic gear train as shown in the figure, the compound wheels A and B as well as internal wheels C and D rotate independently about the axis O. The wheels E and F rotate on the pins fixed to arm a. All the wheels are of the same module. The number of teeth on the wheels are $T_A = 52$, $T_B = 56$, $T_E = T_F = 36$. Determine the speed of C if i) the wheel D fixed and arm a rotates at 200 rpm clockwise ii) the wheel D rotates at 20 rpm counter-clockwise and the arm a rotates at 200 rpm clockwise. (10)



2) With the help of neat sketch derive the equation for the ratio of the maximum and minimum tensions in a band and block brake. (10)

5. 1) A car moving on a level road at a speed of 60 km/hr has a wheel base of 2.76 meters, distance of C.G. from ground level is 500 mm, and distance of C.G. from rear wheels is 1.10 meters. Find the distance travelled by the car before coming to rest when the brake are applied to i) rear wheels ii) front wheels iii) all the four wheels. The coefficient of friction between the road and the tyres is 0.5. (10)

2) With the help of neat sketch derive the equation for the equilibrium speed of the proell governor. (10)

6. 1) Considering gyroscopic couple, derive the equation for the stability of a four wheel drive moving in a curved path. (12)

2) With the help of neat sketch explain the terms used in radial cams. (8)

7. 1) A cam rotating clockwise at a uniform speed of 300 rpm is required to give a tranlatory follower motion defined below a) follower to move outwards through a distance of 50 mm during 150° of cam rotation b) follower to dwell for 30° of cam rotation c) follower to return to its initial position during 120° of cam rotation d) follower to dwell for remaining 60° of cam rotation. The follower motion is **SHM.** Plot the displacement, velocity, acceleration and jerk versus time curves of the follower motion. (12)

2) Explain the following terms relating to governors i) stability ii) sensitiveness iii) isochronism iv) hunting. (8)
