

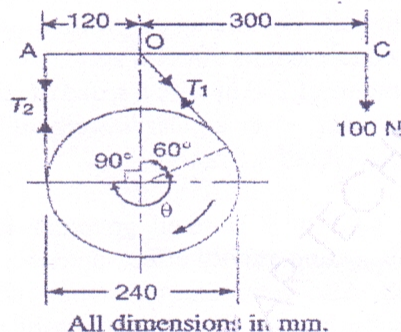
**(OLD COURSE)****Q.P. Code : 3713****(3 Hours)****[Total Marks : 100**

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

**Q1. Attempt any four** (20)

- A. With the help of a neat sketch explain Belt Transmission Dynamometer.  
 B. Classify followers in detail.  
 C. What do you mean by rolling of a ship? Is there any gyroscopic effect during rolling? Give reason to your answer.  
 D. Differentiate between governor and flywheel.  
 E. Which of the two assumptions, uniform intensity of pressure or uniform rate of wear would you make use of in designing friction clutches and why?

- Q2 A.** The simple band brake as shown in figure is applied to a shaft carrying a flywheel of mass 400 kg. The radius of gyration of the flywheel is 450 mm and runs at 300 rpm. If the coefficient of friction is 0.2 and the brake drum diameter is 240 mm, find i) the torque applied due to a hand load of 100 N and ii) the number of turns of the wheel before it is brought to rest. (10)

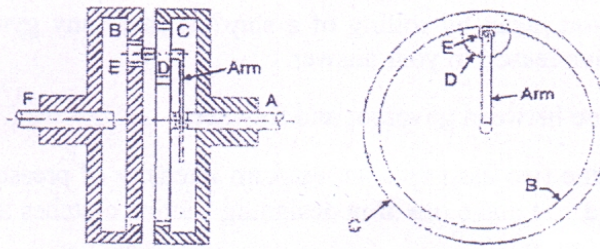


- B.** Derive the equation for the torque transmitting capacity of single plate clutch (10) considering i) uniform pressure theory ii) uniform wear theory.
- Q3 A.** Each arm of a Porter governor is 200 mm long and is hinged at a distance of 40 mm from the axis of the rotation. The mass of each ball is 1.5 kg and the sleeve is 25 kg. When the links are at  $30^\circ$  to the vertical, the sleeve begins to rise at 260 rpm. Assuming that the friction force is constant, find the maximum and minimum speeds of rotation when the inclination of the arms to the vertical is  $45^\circ$ . (10)
- B.** A car moving on a level road at a speed of 50 km/h has a wheel base 2.8 meters, (10) distance of C.G. from ground level 600 mm and the distance of C.G. from rear wheels 1.2 meters. Find the distance travelled by the car before coming to rest when brakes are applied to i) rear wheels ii) front wheels iii) all the four wheels. The coefficient of friction between the tyres and the road may be taken as 0.6.

**[TURN OVER**



- Q4 A. Derive the equation for the stability of a two wheel vehicle taking a turn (10) considering gyroscopic and centrifugal effect.
- B. An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels, D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A coaxial with F. If the wheels have the same pitch and the shaft A makes 800 rpm, what is the speed of the shaft F? (10)



- Q5 A. If the capacity of a single plate clutch decreases by 13% during the initial wear period determine the minimum value of the ratio of internal diameter to external diameter for the same axial load. Consider both the sides of the clutch plate to be effective. (10)
- B. The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 rpm (10) clockwise when viewed from the aft. The radius of gyration of the rotor is 320 mm. Determine the gyroscopic couple and its effect when
- the ship turns right at a radius of 250 m with a speed of 25 km/hr.
  - ship pitches with the bow rising at an angular velocity of 0.8 rad/s.
  - ship rolls at an angular velocity of 0.1 rad/s
- Q6 A. The radius of rotation of the balls of a Hartnell governor is 80 mm at the (10) minimum speed of 300 rpm. Neglecting gravity effect, determine the speed after the sleeve has lifted by 60 mm. Also determine the initial compression of the spring, the governor effort and the power. The particulars of the governor are given below: length of ball arm = 150 mm; length of sleeve arm = 100 mm; mass of each ball = 4 kg and stiffness of the spring = 25 N/mm.
- B. Derive the equation for the ratio of tension in band and block brake. (10)
- Q7 A. A cam with a minimum radius of 25 mm, rotating clockwise at a uniform speed. (14) The motion is described below:
- to raise the valve through 50 mm during  $120^\circ$  rotation of the cam;
  - to keep the valve fully raised through next  $30^\circ$ ;
  - to lower the valve during next  $60^\circ$ ;
  - to keep the valve closed during the rest of the revolution
- The displacement of the valve while being raised and lowered is to take place with SHM. Draw the displacement, velocity and acceleration diagram for one complete revolution of the cam. The cam shaft rotates at 100 rpm.
- B. With the help of neat sketch explain sun and plane gear. (6)