CBCS SCHEME

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15MR42

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Theory of Machines

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Define the following:
(i) Kinematic pair.
(ii) Kinematic chain.
(iii) Degree of freedom. **(06 Marks)**

b. Sketch and explain any two inversions of double slider crank chain. **(10 Marks)**

OR

2 a. What is principle of virtual work? Explain. **(06 Marks)**

b. Explain the procedure for static force analysis of slider crank mechanism subjected to a force on the slider acting along line of stroke. **(10 Marks)**

Module-2

3 a. Explain D'Alembert's principle. **(06 Marks)**

b. Explain the procedure for dynamic force analysis of slider crank mechanism subjected to a force on the slider acting along line of stroke. **(10 Marks)**

OR

4 a. Derive an expression for frictional torque in a conical pivot bearing. Assume uniform pressure across the bearing surface. **(06 Marks)**

b. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a 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 rev/min, if the maximum permissible tension in the belt is 1 kN and the coefficient of friction between the belt and pulley is 0.25? **(10 Marks)**

Module-3

5 a. What do you mean by static balancing and dynamic balancing? **(06 Marks)**

b. A rotating shaft carries four masses 1, 2, 3 and 4 which are radially attached to it. The mass centre are 30 mm, 38 mm, 40 mm and 35 mm respectively from the axis of rotation. The masses 1, 3 and 4 are 7.5, 5 and 4 kg respectively. The axial distance between the planes 1 and 2 is 400 mm and between 2 and 3 is 500 mm. The masses 1 and 3 are at right angles to each other. Find for complete balance,
(i) Angle of the masses 2 and 4 from 1.
(ii) Axial distance between 3 and 4.
(iii) Magnitude of mass 2. **(10 Marks)**

OR

6 A 5 cylinder inline engine running at 500 rpm has successive cranks at 144° apart. The distance between the cylinder centre line is 300 mm. Piston stroke is 240 mm length of connecting rod is 480 mm. Examine the engine for balance of primary and secondary forces and couples. Find the maximum value of these and position of central crank at which these maximum values occur. The reciprocating mass for each cylinder is 150 N. **(16 Marks)**

Module-4

7 a. Define the following:
(i) Isochronism.
(ii) Effort of a governor.
(iii) Stability of a governor. **(06 Marks)**

b. The arms of a porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35 mm from the axis of rotation. The mass of the sleeve is 54 kg and the mass of each ball is 7 kg. Determine the equilibrium speed when the radius of rotation of the ball is 225 mm. What will be the range of speed for this position, if the frictional resistance to the motion of the sleeve is equivalent to a force of 30 N at the sleeve? **(10 Marks)**

OR

8 a. Derive an expression for gyroscopic couple. **(06 Marks)**

b. The rotor of the turbine of a ship has a mass of 1000 kg and radius of gyration 300 mm rotates at 1550 rpm clockwise when looking from the bow. Determine the gyroscopic couple and its effect on the ship in the following cases:
(i) When the ship is speeding at 40 km/hr and takes a right turn in a circular path of 200 m radius.
(ii) When the ship rolls and at the instant, its angular velocity is 0.5 rad/sec clockwise when viewed from the stern. **(10 Marks)**

Module-5

9 A cam of base circle radius 50 mm is to operate a roller follower of 20 mm diameter. The follower is to have SHM during ascent as well as descent. The speed of the cam is 360 rpm clockwise. Draw the cam profile for the cam lift of 40 mm. Angle of ascent = 60°, Angle of dwell = 40° and angle of descent = 90°, followed by dwell again. Also calculate the maximum velocity and acceleration during ascent and descent. **(16 Marks)**

OR

10 A cam has straight working surfaces which are tangential to the base circle of the cam. The follower is a roller follower with line of stroke passing through the axis of the cam. The particulars are the following Base circle diameter = 100 mm; Roller diameter = 50 mm; The angle between the tangential faces of the cam = 90°. The faces are joined by a nose circle of radius = 10 mm. The speed of rotation of cam = 180 rpm. Determine the acceleration of the roller centre.
(i) When the roller just leaves contact of the flank on its ascent.
(ii) When the roller is at its outer end of its lift. **(16 Marks)**

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