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10ME54

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Discuss the equilibrium of the following systems :
(i) Two force members (ii) Three force members
(iii) Members with two forces and a torque. **(09 Marks)**

b. With usual notations, explain the principle of virtual work, considering a Slider Crank Mechanism. **(11 Marks)**

2 a. Discuss the following terms:
(i) Turning Moment Diagram
(ii) Co-efficient of fluctuation of energy
(iii) Co-efficient of fluctuation of speed **(06 Marks)**

b. The turning moment diagram for an engine consists of 2 isosceles triangles, maximum height of each triangle represents turning moment 1000 Nm. The base of each triangle = π radians. If the engine runs at 200 rpm and total fluctuation of speed is not to exceed 3%. Find :
(i) Power of the engine
(ii) Mass of rim type flywheel concentrated at 0.25m radius, neglecting the effect of arms and boss. **(14 Marks)**

3 a. Derive an expression for the ratio of tensions in a flat belt drive. **(06 Marks)**

b. A Belt which is embracing 165° of a pulley of effective diameter 1000 mm is transmitting 10 kW. The pulley is running at 250 rpm. The coefficient of friction is 0.3, mass of belt material 0.0012 gm/mm^3, thickness of belt = 10 mm, considering centrifugal tension, find width of belt, safe working stress is 1.5 MPa. Also determine the initial tension in the belt drive. **(14 Marks)**

4 a. What do you mean by static balancing and dynamic balancing? **(04 Marks)**

b. A rotating shaft carries four radial masses A = 8 kg, B, C = 6 kg, D = 5 kg. The mass centres are 30, 40, 40 and 50 mm respectively from the axis of shaft. The axial distance between the planes of rotation of A and B is 400mm and between B and C is 500 mm. The masses A and C are at right angle to each other. Find for a complete balance (i) the angle of the masses B and D from mass A (ii) the axial distance between the planes of rotation of C and D and (iii) the magnitude of mass B. **(16 Marks)**

PART – B

5 The cranks and connecting rod of a 4 cylinder incline engine running at 1800 rpm are 50mm, 250mm each respectively and the cylinders are spaced 150mm apart. If the cylinders are numbered 1 to 4 in sequence from one end and the cranks appear at intervals of 90° in an end view in the order 1 - 4 - 2 – 3, the reciprocating mass corresponding to each cylinder is 1.5 kg. Determine (i) Unbalanced primary and secondary forces, if any (ii) Unbalanced primary and secondary couples with reference to central plane of engine. **(20 Marks)**

6 a. Explain the terms sensitiveness, stability, effort and power of a governor. **(08 Marks)**

b. The length of upper arm and lower arms of a Portar Governor are 200mm and 250mm respectively. Both the arms are pivoted to the axis of rotation. The central load is 150N, the weight of each ball is 20N and the of the sleeve together with the resistance of the operating gear is equivalent to a force of 30 N at the sleeve. If the limiting inclinations of the upper arm to the vertical are 30° and 40°, determine the range of speed of the governor. **(12 Marks)**

7 a. Derive an expression for the Gyroscopic couple. **(05 Marks)**

b. The motor of a marine having a mass of 1000 kg and radius of gyration 300mm 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 pitches with an angular velocity of 1 rad/sec when the bow a) Rising b) Falling

(ii) When the ship is speeding at 40 km/hr and takes a right turn in a circular path of 200m, radius

(iii) When the ship rolls at certain instant, it has an angular velocity 0.5 rad/sec when viewed from the stern. **(15 Marks)**

8 The following data relate to a symmetrical circular cam operating on a flat-faced follower, least radius = 25mm, nose radius = 8mm, lift of the valve = 10mm, angle of action of cam = 120°, cam shaft speed = 1000 rpm. Determine (i) Flank radius (ii) Maximum velocity (iii) Maximum acceleration (iv) Maximum retardation. If the mass of the follower and valve with which it is in contact is 4 kg, find the minimum force exerted by the spring to overcome the inertia of the moving parts. **(20 Marks)**

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