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06ME53

Fifth Semester B.E. Degree Examination, December 2010
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Use drawing sheets, if needed.

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) Member 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 briefly:
i) Maximum fluctuation of energy ii) Coefficient of fluctuation of energy
iii) Maximum fluctuation of speed iv) Coefficient of fluctuation of speed. **(08 Marks)**

b. A three cylinder single acting engine, has its cranks set equally at 120° and it runs at 600 rpm. The torque-crank angle diagram for each cycle is a triangle for the power stroke, with a maximum torque of 90 N.m at 60° from the dead centre of the corresponding crank. The torque on the return stroke is sensibly zero. Determine
i) Power developed
ii) Coefficient of fluctuation of speed, if the mass of the flywheel is 12kg and has a radius of gyration of 80mm.
iii) Coefficient of fluctuation of energy
iv) Maximum angular acceleration of the flywheel. **(12 Marks)**

3 a. Discuss the types of friction and the laws of friction. **(08 Marks)**

b. 2.5 kW of power is transmitted by an open belt drive. The linear velocity of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165°. The coefficient of friction is 0.3. Determine the effect on power transmission in the following cases:
i) Initial tension in the belt is increased by 8%.
ii) Initial tension in the belt is decreased by 8%.
iii) Angle of lap is increased by 8% by the use of an idler pulley, for the same speed and tension on the tight side and iv) Coefficient of friction is increased by 8% by suitable dressing to the friction sample of the belt. **(12 Marks)**

4 a. Explain in depth, static balancing and dynamic balancing of rotating masses (Graphical and analytical conditions). **(10 Marks)**

b. Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3 m respectively. The angles between successive masses are 45°, 75% and 135°. Find the position and magnitude of the balance mass required, if its radius if rotation is 0.2m. **(10 Marks)**

PART – B

5 a. With usual notations, explain the primary and secondary unbalanced forces of reciprocating masses. **(08 Marks)**

b. A five cylinder in-line engine running at 750 rpm has successive cranks 144° apart; the distance between the cylinder centre lines being 375m. Piston stroke is 225 mm and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of the central crank, at which, these maximum values occur. The reciprocating mass for each cylinder is 15 kg. **(12 Marks)**

6 a. Explain the function and types of governors. **(06 Marks)**

b. Define stability and isochromism of a Governor. **(04 Marks)**

c. The upper arms of a Porter governor has lengths 350mm and are pivoted on the axis of rotation. The lower arms have lengths 300mm and are attacked to the sleeve at a distance of 40mm from the axis. Each ball has a mass of 4 kg and mass on the sleeve is 45 kg. Determine the equilibrium speed for a radius of rotation of 200mm and find the effect and power of the governor, for one percent speed change. **(10 Marks)**

7 a. With usual notations and diagram, derive an expression for the gyroscopic couple, produced by a rotating disc. **(08 Marks)**

b. Each wheel of a motorcycle is 600mm diameter and has a moment of inertia of 1.2 $kg.m^2$. The total mass of motorcycle and the rider is 180 kg and the combined centre of mass is 580mm above the ground level. When the motorcycle is upright, the moment of inertia of the rotating part of the engine is 0.2 $kg.m^2$, the engine speed is five ties the speed of the wheel and is in the same sense. Determine the angle of heel necessary, when the motorcycle takes a turn of 35m radius at a speed of 54 km/hr. **(12 Marks)**

8 a. Classify the cams on the basis of their shapes and the follower movement. Write a note on displacement diagrams. **(08 Marks)**

b. In a four stroke petrol engine, the exhaust valve opens 45° before TDC and closes 15° after the BDC. The valve has a lift of 12mm. The least radius of the circular arc type cam operating a flat faced follower is 25mm. The nose radius is 3mm. The crankshaft rotates at 1500 rpm. Calculate the maximum velocity of the valve and the minimum force exerted by the spring to overcome the inertia of the moving parts weighing 300 g. **(12 Marks)**

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