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10ME54

Fifth Semester B.E. Degree Examination, June/July 2019
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least 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) 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. Define the terms co-efficient of fluctuation of speed and co-efficient of fluctuation of energy. **(04 Marks)**

b. The turning moment curve for an engine is represented by the equation, $T = (20{,}000 + 9500\sin 2\theta - 5700\cos 2\theta)$ N-m, where θ is the angle moved by the crank from inner dead centre. If the resisting torque is constant, Find,

(i) Power developed by the engine.

(ii) Moment of inertia of flywheel in kg-m^2, if the total fluctuation of speed is not to exceed 1% of mean speed which is 180 rpm.

(iii) Angular acceleration of the flywheel when the crank has turned through 45° from inner dead centre. **(16 Marks)**

3 a. Derive an expression of total frictional torque for a flat collar bearing subjected to uniform pressure. **(08 Marks)**

b. A leather belt is required to transmit 7.5 KU from a pulley 1.2 m in diameter, running at 250 rpm. The angle of constant is 165° and coefficient of friction between the belt and pully is 0.3. If the safe working stress for the leather belt is 1.5 MPa and density of leather is 1000 kg/m^3 and thickness of belt is 10 mm. Determine the width of belt taking centrifugal tension into account. **(12 Marks)**

4 a. Explain the static and dynamic balancing. **(04 Marks)**

b. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass 'A' and the relative angular settings of the four masses so that the shaft shall be in complete balance. **(16 Marks)**

PART – B

5 a. What is Hammer blow? Write an equation for maximum magnitude of Hammer blow. **(05 Marks)**

b. The three cranks of a three cylinder locomotive are all on the same axle and are set at 120°. The pitch of cylinders is 1 m and the stroke of each piston is 0.6 m. The reciprocating masses are 300 kg for inside cylinder and 260 kg for outside cylinder and the planes of rotation of the balance masses are 0.8 m. From the inside cranks. If 40% of the reciprocating parts are to be balanced. Find

(i) The magnitude and position of the balancing masses required at a radius of 0.6 m.t.

(ii) Hammer blow per wheel when the axle make 6 rps. **(15 Marks)**

6 a. Define the following:
(i) Sensitiveness (ii) Hunting (iii) Governor power (iv) Stability
(v) Isochronous governor. **(10 Marks)**

b. A porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the maximum and minimum speeds and range of speed of governor. **(10 Marks)**

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

b. A rear engine automobile is travelling along a track of 100 mts mean radius. Each of four road wheels has a moment of inertia of 2.5 kg-m^2 and effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of 1.2 kg-m^2. The engine axis is parallel to the rear axle and crank shaft rotates in the same sense as the road wheels. The ratio of engine speed to back axle speed is 3:1. The automobile has a mass of 1600 kg and has its centre of gravity 0.5 m above road level, the width of the track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with road surface. Assume that road surface is not cambered and centre of gravity of automobile lies centrally with respect to the four wheels. **(15 Marks)**

8 A symmetrical circular cam operating a flat faced follower has the following particulars:
Minimum radius of the cam = 30 mm,
Total lift = 20 mm,
Angle of lift = 75°,
Nose radius = 5 mm,
Speed = 600 rpm
Determine
(i) The principal dimensions of the cam
(ii) The acceleration of the follower at the beginning of the lift, at the end of contact with circular flank, at the beginning of contact with nose and at the apex of nose. **(20 Marks)**

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