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10AE53

Fifth Semester B.E. Degree Examination, June/July 2015
Dynamics of Machines

Time: 3 hrs.

Max. Marks:100

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

PART – A

- 1 a. State the conditions for a member to be in equilibrium:
 - i) When two forces acts
 - ii) When three forces acts
 - iii) When two forces and a torque act. (09 Marks)
 b. With usual notations, explain the principle of virtual work, considering a slider crank mechanism. (11 Marks)

- 2 a. Define: i) Maximum fluctuation of speed; ii) Co-efficient of fluctuation of speed. (04 Marks)
 b. A shaft fitted with a flywheel rotates at 240rpm and drives a machine. The torque of the machine varies in a cyclic manner over a period of 3 revolutions. The torque rises from 1000Nm to 4000Nm uniformly during half revolution and remains constant during the following one revolution, it then falls uniformly to 1000Nm during the next half revolution and remains constant for one revolution. This being repeated there after, determine:
 - i) Power required to drive the machine
 - ii) Percentage fluctuation of speed.
 The driving torque applied to the shaft is constant and the mass of flywheel is 520kg with radius of gyration 625mm. Design the flywheel rim of width is 4 times the thickness. (16 Marks)

- 3 a. Discuss the type of friction and laws of friction. (06 Marks)
 b. A leather best is required to transmit 15kW from pulley of 1200mm effective diameter running at 300rpm. The angle of contact is spread over $\frac{5}{12}$ of circumference and co-efficient of friction between belt and pulley is 0.3. If the safe working stress for the belt material is 1.5MPa and mass of leather is 1000 kg/m³ and thickness of belt is 10mm, determine the width of the belt taking centrifugal tension into account. (14 Marks)

- 4 a. State and explain static and dynamic balancing. (06 Marks)
 b. A 3.6m long shaft carries 3 pulleys, two at its two ends and 3rd pulley at the mid point. The two end pulleys have masses 79 and 40kg respectively and their C.G are 3mm and 5mm from the axis of shaft respectively. The middle pulley has a mass of 50kg and C.G. is 8mm. The pulleys are so keyed to the shaft that the assembly is in static balance. The shaft at 300rpm in 2 bearings, 2.4m apart, with equal overhangs on either side. Determine:
 - i) Relative angular position of the pulleys.
 - ii) Dynamic reaction on the two bearings. (14 Marks)

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 – B

- 5 The cranks and connecting rod of a 4 cylinder inline engine running at 1800rpm 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 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 1.5kg. Determine:
- Unbalanced primary and secondary forces if any
 - Unbalanced primary and secondary couples with reference to central plane of engine. (20 Marks)
- 6 a. Define the following terms:
- Controlling force
 - Sensitiveness
 - Isochronism
 - Stability of governor. (08 Marks)
- b. A porter governor has all four arms 300mm long the upper arms are pivoted on the axis of rotation and lower arms are attached to the sleeve at a distance 35mm from axis. The mass of each ball is 7kg and the load on the sleeve is 540N. Determine the equilibrium speed for the two extreme radii of 200mm and 260mm of rotating of governor balls. (12 Marks)
- 7 a. Describe the effect of gyroscopic couple on aeroplane for all conditions. (10 Marks)
- b. An aeroplane makes a complete half cycle of 50m radius towards left when flying at 200km/hr. The mass of rotary engine and propeller is 400kg with radius of gyration 300mm. The engine runs at 300 rpm counter clockwise when viewed from the rear. Determine the gyroscopic couple and its effect on the aircraft. (10 Marks)
- 8 a. Explain with diagram Tangent cam with roller follower. (05 Marks)
- b. In a four stroke petrol engine, the crank angle is 4° after t.d.c. When the suction valve opens and 50° after b.d.c. when the section valve closes. The lift is 10mm, the nose radius is 2.5mm and the least radius of the cam 20mm. The shaft rotates at 600rpm. The cam is of the circular type with a circular nose and flanks while the follower is flat faced. Determine the maximum velocity, maximum acceleration and retardation of the valve. What is minimum force exerted by the springs to overcome the inertia of moving parts weighing 200gm. (15 Marks)

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