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10AU54

Fifth Semester B.E. Degree Examination, May 2017
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. With neat sketch discuss the equilibrium of the following system :
   i) Three force members
   ii) Member with two forces and a torque. **(04 Marks)**

b. A four link mechanism is subjected to following external forces shown in Fig.Q1(b). **(16 Marks)**

Link	Length	Force	Magnitude	Points of application of force
AB(2)	500mm	F_2	80 ∠73.5°N	325mm from A
BC(3)	660mm	F_3	144 ∠58°N	297mm from B
CD(4)	560mm	F_4	60 ∠42°N	373mm from D
AB(1)	1000mm	Fixed link		

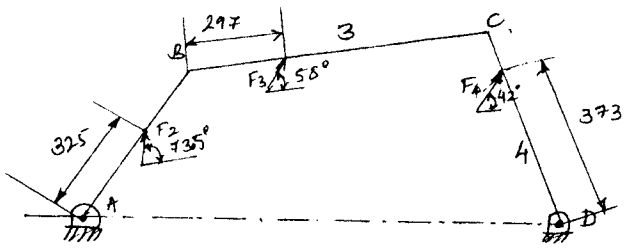

Fig.Q1(b)

2 a. Explain with a neat sketch inertia of the connecting rod. **(06 Marks)**

b. The lengths of crank rod and connecting rod of a vertical reciprocating engine 400 mm and 2m respectively. The crank is rotating clock wise at a speed of 400rpm. The mass of he connecting rod is 250 kg and distance of its centre of gravity from the cross-head pin centre is 1.2m. Find the torque exerted on the crankshaft due to the inertia of moving parts analytically when crank has turned through 40° from top dead centre and piston is moving down wards. The radius of gyration of connecting rod about an axis passing through its centre of gravity is 900mm. **(14 Marks)**

3 a. Derive the expression for maximum fluctuation of energy and find the relationship between K_e and K_S. **(10 Marks)**

b. A gas engine working on otto cycle is provided with 2 flywheels. Each of mass 140 bgs and radius of gyration 0.7m. The cylinder is 0.24m diameter, stroke is 0.27m and mean speed is 250 rpm. The mean pressure during the cycles are :
   i) Suction stoke = Atmospheric pressure
   ii) Comp. stroke pressure = 10.6 N/cm^2
   iii) Firing stroke pressure = 62N/cm^2
   iv) exhaust stroke pressure = 5 N/cm^2

If the resistance is to be constant. Find the percentage variation of speed of engine. **(10 Marks)**

4 a. Derive an expression for displacement, velocity and acceleration, when the flat face of the follower has contact on the circular flank. **(08 Marks)**

b. A cam straight working faces which are tangential to a base circle of diameter 90mm. The centre of roller moves along a straight line passing through the centre line of the cam shaft. The angle between the tangential faces of the cam is 90° and the faces are joined by a nose circle of 10mm radius. The speed of the rotation of the cam is 120 revolutions per min. Find the acceleration of the roller centre. i) when during the lift, the roller is just about to leave the straight flank. **(12 Marks)**

PART – B

5 a. A 3.6m long shaft carries 3 pulleys, two at its two ends and the 3rd pulley at the midpoint. The two end pulleys have masses 79 and 40 kg respectively and their C.G are 3 mm and 5mm from the axis of shaft respectively. the middle pulley has a mass of 50 kg and its C.G is 8 mm. The pulleys are so keyed to the shaft that the assembly is in static balance. The shaft rotates at 3000rpm in 2 bearings, 2.4m apart, with equal overhangls on either side. Determine :

i) Relative angular position of the pulleys

ii) Dynamic reaction on the two bearings. **(16 Marks)**

b. Explain the balancing of several masses rotating in same plane. **(04 Marks)**

6 a. What are in-line engines and state how they are balanced? **(05 Marks)**

b. In 5 cylinder radial engine the cylinders are equally spaced. Mass of reciprocating parts per cylinder is 1 kg stroke length is 0.1m and length of CR is 0.15m. When the engine rotates at 3000rpm find the maximum unbalanced primary and secondary forces. **(15 Marks)**

7 a. Define the following terms :

i) Sensitiveness

ii) Isochronism. **(10 Marks)**

b. A Hartnell type spring loaded governor rotates about vertical axis. The two rotating masses of 1 kg each move at radius of 0.12m, when the speed is 550 rpm. The arms 100mm and 75mm length are respectively vertical and horizontal. When the equilibrium speed is 975rpm, the rotating masses are at their maximum radius 145mm. Determine the stiffness of the spring and compression at 550 rpm and the radius at which the masses rotate when the equilibrium speed is 525rpm. **(10 Marks)**

8 a. Derive an expression for stability of two wheeler negotiating a curve. **(08 Marks)**

b. A rear engine automobile is travelling along a track of 100m mean radius. Each of four road wheels has moment of inertia of 2 kg m^2 and an effective diameter of 60 cm. The rotating parts of the engine has a moment of intertia of 1 kg $m^{@}$. The engine axis is parallel to the rear axle. The crank shaft rotates in the same sense as the road wheels. The gear ratio of engine to back axle is 3 : 1. The mass of the vehicle is 1500 kg and has its C.G. 500mm above the road level. Width of the track is 1.5m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface if this is not cambered. **(12 Marks)**

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