CBCS SCHEME

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17AU52

Fifth Semester B.E. Degree Examination, June/July 2024
Dynamics of Machines

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Discuss about static Equilibrium of member with two force and three forces. **(06 Marks)**

b. Determine various forces on the link and couple T_2 shown in below Fig.Q.1(b). Where AB = 300mm, BC = 600mm and BD = 200mm. **(14 Marks)**

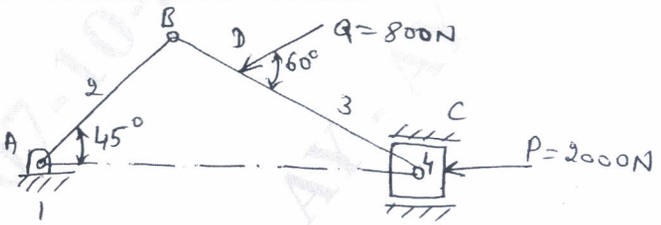

Fig. Q1(b)

OR

2 a. Explain the procedure for analysis of four bar mechanism for static Equilibrium. **(10 Marks)**

b. When the crank is 45° from the inner dead centre on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 2.5bar. The diameter of the cylinder is 0.75m, stroke of the piston is 0.50m and length of connecting rod is 1m. Determine the torque on the crank shaft, if the engine runs at 350rpm and the mass of reciprocating parts is 200kg. **(10 Marks)**

Module-2

3 A 3.6 m long shaft carries 3 pulleys, two at its two ends and the 3rd pulley at the mid point. The two end pulleys have masses 79 and 40 kg respectively and their C.G are 3 mm and 5 mm from the axis of the shaft. 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 300 rpm in 2 bearings, 2.4 m apart, with equal overhangs on either side. Determine :

i) Relative angular position of the pulleys.

ii) Dynamic reaction on the two bearings. **(20 Marks)**

OR

4 A 5 cylinder inline engine running at 500 rpm has successive cranks at 144° apart. The distance between the cylinder centre line is 300 mm. Piston stroke = 240 mm. Length of connecting rod = 480 mm. Examine the engine for balancing of primary and secondary forces and couples. Find the maximum value of these and position of central crank at which these maximum values occur. The reciprocating mass for each cylinder is 150 N. **(20 Marks)**

Module-3

5 a. Compare between Functions of Flywheel and Governor. **(10 Marks)**

b. Classify Governor's and explain working principle of a Simple Centrifugal Governor. **(10 Marks)**

OR

6 a. Define : i) Sensitiveness ii) Hunting iii) Stability iv) Isochronous 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 rotation of governor balls. **(12 Marks)**

Module-4

7 a. Derive an expression for frictional torque of flat pivot bearing considering uniform pressure. **(10 Marks)**

b. A conical pivot with angle of cone as 120° supports a vertical shaft of diameter 300mm. It is subjected to a load of 20kN. The CoF is 0.05 and the speed of shaft is 210rpm. Calculate the power lost in friction assuming:
i) Uniform pressure ii) Uniform wear.. **(10 Marks)**

OR

8 a. Prove that $\frac{T_1}{T_2} = e^{\mu\theta}$. **(10 Marks)**

b. An open belt is required to transmit 7.5kW from a pulley 1.5m in diameter and running at 250rpm. The angle or lap is 165° and then the CoF is 0.3. If the safe working stress of the belt is 1.5MPa. Density of material is 1kg/m^3 and the thickness of the belt is 10mm. Determine the width of the belt taking centrifugal tension in to account. **(10 Marks)**

Module-5

9 a. Derive an expression for angle of heel of a two-wheel vehicle while negotiating a curve. **(10 Marks)**

b. A rear engine automobile is travelling along a track of 100 m mean radius. Each of four road wheels has a 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 inertia of 1 kg m^2. 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 500 mm above road level. Width of track is 1.5 m. Determine the limiting speed of the vehicle around the work for all four wheels to maintain contact with the road surface if this is not cambered. **(10 Marks)**

OR

10 For a symmetrical tangent cam operating a roller follower, the least radius of cam is 30 mm and roller radius is 15 mm. The angle of ascent is 60°, the total lift is 15 mm and the speed of the cam shaft is 300 rpm. Calculate (i) Principal dimensions of cam (ii) Acceleration and velocity of the follower at the beginning of the lift. (iii) Acceleration and velocity of the follower when the roller just touches the nose (iv) Acceleration and velocity of the follower when the roller contact is on the circular nose (v) Acceleration and velocity of the follower at the apex of the circular nose. Assume that there is no dwell between ascent and descent. **(20 Marks)**

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