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10ME54

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Dynamics of Machines

Time: 3 hrs.

Max. Marks:100

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

PART – A

1 a. Using sketches explain equilibrium of two and three force members. **(04 Marks)**
   b. A force of 6000N is applied on a piston along the line of stroke of a horizontal steam engine when the crank is at 30° to I.D.C. Calculate the torque on the crank shaft, length of connecting rod is 0.8m and length of stroke is 0.4m. **(16 Marks)**

2 a. Using Turning moment diagram explain how speed of fly wheel decreases and increases. **(05 Marks)**
   b. Turning moment diagram of a multi-cylinder engine with respect to mean energy line are given by -0.35, +4.1, -2.85, +3.25, -3.35, +2.6, -3.65, +2.85, -2.6mm^2 each mm^2 represents 500Nm torque. The engine at 1000rpm with limitation for fluctuation of speed as 2% of mean speed. Find suitable diameter and cross section of rim, if ρ = 7200kg/m^3 and rate stress is 6MPa, neglect the effect of arms. Take width of the C/S twice of the thickness. **(15 Marks)**

3 a. Derive an equation to determine the ration of belt tensions applied to flat belt drive. **(05 Marks)**
   b. Determine the maximum power that can be transmitted using a belt of 100mm × 10mm with an angle of lap of 160°. The density of the belt material is 10^{-6}kg/mm^3 and coefficient of friction is 0.25. The tension in the belt should not exceed 1.5N/mm^2. **(15 Marks)**

4 a. Explain why two balancing masses in two different planes has to be introduced to balance the disturbing mass rotating in other plane. **(05 Marks)**
   b. Four masses of magnitude 5kg, 6kg, 7kg and Mkg revolve in planes A, B, C and D respectively. The planes are placed A to B 0.8m, A to C 1.2m and A to D 2m. The masses are all at the same radius. Find magnitude of 'M' and the relative angular positions of the masses for the complete balance. **(15 Marks)**

PART – B

5 a. Using diagram, explain direct and reverse crank method. **(06 Marks)**
   b. Three cylinders have their axis at 120° to one another and their connecting rods are coupled to a single crank. The stroke's 120mm and the length of each connecting rod is 190mm. Mass of reciprocating parts per cylinder is 1.8kg and the speed of the engine is 2200rpm. Determine: i) The balance mass to be attached at 80mm radius to give primary balance ii) The nature and magnitude of secondary unbalanced force. **(14 Marks)**

6 a. Derive an equation to determine the speed of the portor governor. Considering friction on sleeve and eccentricity of lower arm. **(06 Marks)**

b. The mass of each ball of a spring controlled governor is 1.4kg. The bell crank lever has its vertical arm 90mm and horizontal arm 40mm. The distance of fulcrum from axis of rotation is 45mm. The sleeve has a mass of 7.5kg. The sleeve begins to rise at 220rpm. The rise of the sleeve for 6% rise in speed is 8mm. Find the initial thrust on the spring and its stiffness. **(14 Marks)**

7 a. Derive an equation to determine the angle of heel for 2-wheel automobile. **(06 Marks)**

b. An automobile is travelling along a curved track of 200m mean radius. Each of the 4-road wheels has a mass of 80kg with a radius of gyration of 0.4m. The rotating part of the engine have a mass moment of inertia of 10kg-m^2. The crank shaft rotates in the same direction as road wheels. The gear ratio of the engine to the back axle is 5:1. The vehicle has a mass of 3000kg and its C.G is 0.5m. Above the road level. The width of the track of the vehicle is 1.5m. Calculate the limiting speed of the vehicle around the curve for all wheels to maintain contact with the road surface. **(14 Marks)**

8 a. Using diagrams explain 'under cutting in cams' **(06 Marks)**

b. A symmetrical cam with convex flanks operating on a flat faced follower has base circle diameter of 75mm and nose radius of 10mm. The lift of the follower is 20mm. The cam is symmetrical total angle of action is 120°. Determine the principal dimensions of the cam and sketch the same. **(14 Marks)**

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