CBCS SCHEME

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18AU52

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. What are the conditions for a body to be in equilibrium under the action of two forces , three forces and two force with couple? **(10 Marks)**

b. Determine the required input torque on the crank of a slider – crank mechanism for the state equilibrium when the applied piston load is 1500N. The length of the crank and connecting rod are 40 mm and 100 mm respectively and the crank has turned through 45° from the inner – dead center. **(10 Marks)**

OR

2 a. Derive an expression for acceleration of piston. **(10 Marks)**

b. The crank radius of horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from IDC, the difference between the driving and the back pressure is 0.35 N/mm^2. The connecting rod length between centers is 1.2m and cylinder bar is 0.5m. If the engine runs at 250 rpm and if the effect of piston rod die is neglected. Calculate i) Pressure on side bars ii) Thrust in connecting rod iii) Tanjential force on crank pin iv) Turning moment on crank shaft. **(10 Marks)**

Module-2

3 A, B, C, D are four mass carried by a rotating shaft and radi 100 , 125 , 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and mass of B, C and D are 10 kg , 5 kg and 4 kg respectively. Find the required mass A and relative angular settings of the four masses so that the shaft shall be in complete balance. **(20 Marks)**

OR

4 Each crank and the connecting rod of a six cylinder four stroke in line engine are 60 mm and 240 mm respectively. The pitch distance between cylinder center line on 80 mm , 80 mm , 100 mm , 80 mm and 80 mm respectively. The reciprocating mass of each cylinder is 1.4 kg. The engine speed is 1000 rpm. Determine the out of balance primary and secondary forces and couple on the engine if the firing order be 142635. Take a plane midway between the cylinder 3 and 4 as the reference plane. **(20 Marks)**

Module-3

5 a. Find a relation for the co-efficient of fluctuation of speed in terms of maximum fluctuation of energy and the kinetic energy of the flywheel at mean speed. **(06 Marks)**

b. The turning moment diagram for a multicylinder engine has been drawn to a scale 1 mm = 600 N – m vertically and 1 mm = 3° horizontally. The interrupted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows + 52 , -125 , + 92 , -140 , +85 , -72 and + 107 mm^2, when the engine is running at a speed of 600 rpm. If the total fluctuation of speed is not to exceed ± 1.5% of mean , find the necessary mass of the flywheel of radius 0.5m. **(14 Marks)**

OR

6 a. Derive expression for speed of porter governor. **(10 Marks)**

b. In a spring loaded hartnell type governor, the extreme radii of rotation of the balls are 80mm and 120 mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 and 420 rpm , find i) Initial compression of the central spring ii) The spring constant. **(10 Marks)**

Module-4

7 a. What is friction? What are various kinds of friction? Define the terms coefficient of friction also define laws of friction. **(10 Marks)**

b. The following data relate to a screw jack :
Pitch of threaded screw = 8 mm ; Dia. of threaded screw = 40 mm ;
Co-efficient of friction between screw and nut = 0.1 ; Load = 20 kN.
Assuming that the load rotates with the screw, determine the
i) Ratio of torque required to rise and lower the load.
ii) Efficiency of the machine. **(10 Marks)**

OR

8 a. Derive expression for ratio of friction tension for flat belt. **(10 Marks)**

b. Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The co-efficient of friction between the belt and the pulley is 0.25 , angle of lap 160° and maximum tension in the belt is 2500N. **(10 Marks)**

Module-5

9 a. What is the effect of gyroscopic couple on the stability of a four wheeler while negotiating a curve? **(10 Marks)**

b. The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration 0.6m. It rotates at 1800 rpm. Clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steer to the left in a curve of 75m radius. **(10 Marks)**

OR

10 Derive equation for maximum and minimum velocity of circular arc cam with flat faced follower with :

a. Follower Touching circular flank.

b. Follower on the news. **(20 Marks)**

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