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18AU52

Fifth Semester B.E. Degree Examination, July/August 2022
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 static equilibrium of i) two force ii) three force iii) Two force and torque member. **(06 Marks)**

b. A slider crank mechanism is shown in Fig Q1(b). The force applied to the piston is 1000N when the crank is at 120° from IDC. Determine the input torque, T on the link OA for the static equilibrium of the mechanism for the given configuration.
OA = 200mm, AB = 900mm

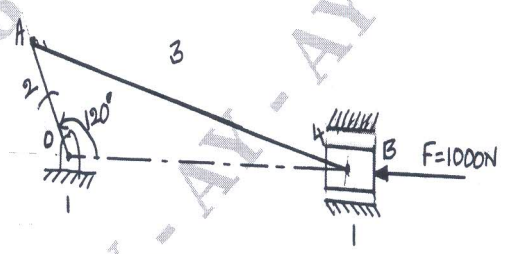

Fig Q1(b) **(14 Marks)**

OR

2 a. Write a short note on "Dynamically equivalent system". **(08 Marks)**

b. In a vertical double acting engine, the connecting rod is 4.5 times the crank. Stroke of the piston is 400mm and the mass of the reciprocating parts is 100kg. The engine runs at 250rpm. If the net load on the piston due to stream pressure is 25kN when the crank has turned through an angle of 120° from the top dead centre, determine :
i) Net force on the piston or piston effort
ii) Force acting along the connecting rod
iii) Thrust on the sides of cylinder walls
iv) Crank pin effort or Tangential force on the crank pin
v) Thrust on crank shaft bearing
vi) Turning moment or Torque on the crank shaft. **(12 Marks)**

Module-2

3 a. Explain static and dynamic balancing. **(04 Marks)**

b. Four masses M_1 = 100Kg, M_2 = 175Kg, M_3 = 200Kg and M_4 = 125Kg are fixed to the crank of 200mm radius and revolve in planes 1, 2, 3 and 4 respectively. The angular position of the planes 2, 3 and 4 with respect to 1 are 75°, 135° and 240° taken in the same sense. Distances of the planes 2, 3 and 4 from 1 are 600mm, 1800mm and 2400mm. Determine the magnitude and position of the balancing masses at radius 600mm in planes 'L' and 'M' located in the middle of 1 and 2 and in the middle of 3 and 4 respectively. **(16 Marks)**

OR

4 a. Explain inertia effects of crank and connecting rod. **(08 Marks)**

b. In a four cylinder engine the two outer crank are at 120° to each other and their reciprocating masses are each 100Kg. The distance between the planes of rotation of adjacent cranks are 450mm, 750mm and 450mm. Length of each crank is 300mm and length of each connecting rod is 1200mm. Speed of engine is 240 rpm. Find the reciprocating masses and relative angular positions for each of the inner cranks. **(12 Marks)**

Module-3

5 a. Obtain an expression for the hoop stress developed in rim of a flywheel. **(08 Marks)**

b. A engine develops 36.8kW at 300rpm. The maximum variation of energy per revolution has been found to be 30% of mean energy and the total speed variation is 1%. Determine the mass of rim and the dimension of the square section for a mean speed of 900m/min, assuming that 90% of the flywheel effect is provided by the rim. Assume that the density of C.I = 7.08gm/CC. **(12 Marks)**

OR

6 a. Derive an expression for height of porter 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 total frictional torque of flat collar bearing considering uniform pressure and uniform wear. **(10 Marks)**

b. Derive an expression for total frictional torque in conical pivot bearing considering uniform pressure and uniform wear. **(10 Marks)**

OR

8 a. Derive an expression for Length of cross belt drive. **(10 Marks)**

b. Derive an expression for ratio of tensions in flat belt drive. **(10 Marks)**

Module-5

9 Discuss all 8 cases of gyroscopic effect on aeroplane. **(20 Marks)**

OR

10 a. Derive an expression for displacement, velocity and acceleration of follower when the roller is in contanct with straight flank. **(10 Marks)**

b. Derive an expression for displacement, velocity and acceleration, when the flat face of the follower has contact on the circular flank. **(10 Marks)**

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