CBCS SCHEME

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15AU52

Fifth Semester B.E. Degree Examination, June/July 2019
Dynamics of Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 A four link mechanism is subjected to following external forces as shown in Fig.Q1. Take AB = 500 mm, BC = 660 mm, CD = 560 mm, AD = 1000 mm and $\angle BAD = 60°$. Use superposition method to determine the torque to be applied on the link AB for static equilibrium.

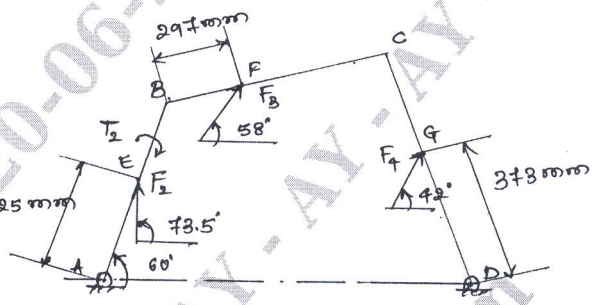

Fig.Q1 **(16 Marks)**

OR

2 a. Write a short note on "Dynamically equivalent system". **(06 Marks)**

b. The connecting rod of a gasoline engine is 300 mm long between its centres. It has a mass of 15 kg and mass moment of inertia of 7000 kg-mm^2. Its centre of gravity is 200 mm from its small end centre. Determine the dynamically equivalent two-mass system of connecting rod, if one of the masses is located at the small end centre. **(10 Marks)**

Module-2

3 a. Explain any one procedure of "two plane balancing of rotating masses'. **(04 Marks)**

b. A shaft carries three masses in planes A, B and C. Planes B and C are 600 mm and 1200 mm from plane A. Masses in planes A, B and C are 50 kg, 40 kg and 60 kg respectively at a radius of 25 mm. The angular position of mass B and C with A are 90° and 210° respectively. Find the unbalanced force and couple, if the shaft revolves at 300 rpm. Also find the position and magnitude of balancing mass required at 100 mm radius in planes L and M midway between A and B and between B and C. **(12 Marks)**

OR

4 a. What are in-line engines? State the conditions of balance in multi-cylinder 'In-line engine'. **(06 Marks)**

b. A single engine has following data:
Speed = 250 rpm, stroke = 350 mm, mass of the reciprocating parts = 60 kg, mass of revolving parts at 175 mm radius is 40 kg. If 2/3rd of reciprocating parts and all the revolving parts are to be balanced, find:
i) Balancing mass required at 400 mm radius.
ii) Residual unbalanced force, when the crank has rotated, 60° from top dead centre. **(06 Marks)**

c. Prove that the resultant unbalanced force is minimum, when half of the reciprocating masses are balanced by rotating masses. **(04 Marks)**

Module-3

5 a. Obtain an expression for the hoop stress developed in the rim of a flywheel. **(06 Marks)**

b. A engine develops 36.8 KW at 300 rpm. 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 900 m/min, assuming that 90% of the flywheel effect is provided by the rim. Assume that the density of cast iron is 7.08 gm/cc. **(10 Marks)**

OR

6 a. Write a short note on centrifugal Governor. **(06 Marks)**

b. The arms of a porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the Sleeve at a distance of 35 mm from the axis of rotation. The mass of the Sleeve is 54 kg and the mass of each ball is 7 kg. Determine the equilibrium speed, when the radius of rotation of the ball is 225 mm. What will be the range of speed for this position, if the frictional resistance to the motion of the Sleeve is equivalent to a force of 30 N at the Sleeve. **(10 Marks)**

Module-4

7 a. Define the following: i) Solid friction ii) Rolling friction **(04 Marks)**

b. Write a short note on "law of friction". **(04 Marks)**

c. Explain the following: i) Flat pivot bearing ii) Flat collar bearing **(08 Marks)**

OR

8 a. Derive an expression for ratio of tensions in flat belt drive. **(08 Marks)**

b. Belt of 100 mm width and 10 mm thick is transmitting power at 1000 m/min. The net driving tension is 1.8 times the tension on slack side. If the safe permissible stress is 2 MPa. Calculate the maximum power that can be transmitted at this speed. Assume the density of leather as 1000 kg/m^3. Also calculate the absolute maximum power that can be transmitted by this belt and the speed at which this can be transmitted. **(08 Marks)**

Module-5

9 a. Define the following: i) Axis of spin ii) Axis of precision. **(04 Marks)**

b. Explain the gyroscopic effect of steering of a ship moving in a sea. **(12 Marks)**

OR

10 The following data related to a symmetrical circular cam operating on a flat faced follower. Least radius = 25 mm, nose radius = 8 mm, lift of the value = 10 mm, angle of action of cam = 120°, cam shaft speed = 1000 rpm. Determine:

i) Flank radius ii) Maximum velocity

iii) Maximum acceleration iv) Maximum retardation

If the mass of the follower and valve with which it is in contact is 4 kg. Find the minimum force exerted by the spring to overcome the inertia of the moving parts. **(16 Marks)**

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