CBCS SCHEME

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17AU52

Fifth Semester B.E. Degree Examination, July/August 2021
Dynamics of Machines

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Discuss the static equilibrium of,
(i) Two force member.
(ii) Three force member.
(iii) Member with two force and a torque. **(06 Marks)**

b. A four bar link mechanism with the following dimensions is acted upon by a force of 80N ∠150° on the link DC. AD = 500 mm, AB = 400 mm, BC = 1000 mm, DC = 750 mm and DE = 350 mm.
Determine the input torque T on the link AB for the static equilibrium of the mechanism shown in Fig. Q1 (b). **(14 Marks)**

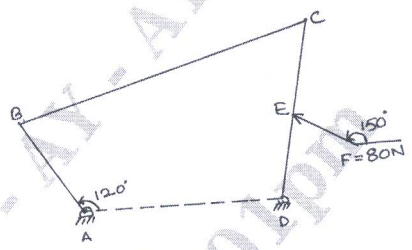

Fig. Q1 (b)

2 a. Define inertia force and inertia torque. **(02 Marks)**

b. Briefly explain "Dyanmically equivalent system". **(06 Marks)**

c. When the crank is 45° from inner dead centre on the down stroke, the effective pressure on the piston of a vertical steam engine is 2.5 bar. The diameter of the cylinder = 0.75 m, stroke of the piston = 0.50 m and length of the connecting rod = 1 m. Determine the torque on the crank shaft, if the engine runs at 350 rpm and the mass of reciprocating parts is 200 kg. **(12 Marks)**

3 a. Explain "Static balance" and "dynamic balance" as applied to revolving masses in different planes. **(04 Marks)**

b. Four masses M_1 = 100 kg; M_2 = 175 kg ; M_3 = 200 kg and M_4 = 125 kg are fixed to the crank of 200 m 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 600 mm, 1800 mm and 2400 mm. Determine the magnitude and position of the balancing masses at radius 600 mm in planes 'L' and 'M' located in the middle of 1 and 2 and in the middle of 3 and 4. **(16 Marks)**

4 The piston of a 4 cylinder vertical inline engine reach their uppermost position at 90° interval in order of their axial position. Pitch of cylinder = 0.35 m, Crank radius = 0.12 m Length of connecting rod = 0.42 m. The engine runs at 600 rpm. If the reciprocating parts of each engine has a mass of 2.5 kg, find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(20 Marks)**

5 a. Obtain an expression for the Hoop stress developed in the rim of a flywheel. **(10 Marks)**

b. A gas engine working on 4-stroke engine develops 11.04 kW at 250 rpm. Assuming that the resistance is uniform and that the speed is not to vary more than 1% above or below the mean speed. Calculate the mass of flywheel required if the mean diameter is 1 m and the fluctuation of energy is equal to 0.3 times the work done per cycle. **(10 Marks)**

6 a. Explain the terms : (i) Sensitiveness, (ii) Stability (iii) Isochronism, (iv) Controlling force, (v) Hunting in connection with governors. **(10 Marks)**

b. The arms of a porter governor are each 30 cm long and are pivoted on the governor axis. Mass of each ball is 2 kg. At the mean speed of 150 rpm, the arm makes 30° with the vertical. Determine the central load and the sensitivity of the governor, if the sleeve movement is ± 2.5 cm. **(10 Marks)**

7 a. Derive an expression for frictional torque developed in a flat collar bearing by considering,

(i) Uniform pressure

(ii) Uniform wear. **(12 Marks)**

b. A flat foot step bearing 300 mm in diameter supports a load of 10 kN. If the coefficient of friction is 0.1 and speed of the shaft is 60 rpm, find the power lost in friction, assuming (i) Uniform pressure (ii) Uniform wear. **(08 Marks)**

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

b. A leather belt weighing 1.1 gm/cm^3 has a maximum permissible stress of 2.1 MPa. Determine the maximum power that can be transmitted by a belt of 250 mm wide and 10 mm thick, if the ratio of frictional tension in tight to slack side is 2. **(10 Marks)**

9 a. Explain the gyroscopic effect of steering, pitching and rolling of a ship moving in a sea. **(10 Marks)**

b. An aeroplane makes a complete half circle of 50 m radius towards left when flying at 200 km/hr. The mass of the rotary engine and propeller is 400 kg with radius of gyration 300 mm. The engine runs at 3000 rpm counter clockwise when viewed from the rear. Determine the gyroscopic couple and its effect on the aircraft. **(10 Marks)**

10 The following data relate to a symmetrical cam operating on a flat faced follower:
Least radius = 25 mm ; Nose radius = 8 mm ; Lift = 10 mm; Angle of action = 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. **(20 Marks)**

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