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CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–I–Semester End Examinations (Supply) - June- 2024
DYNAMICS OF MACHINERY
(MECH)

[Time: 3 Hours] **[Max. Marks: 70]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks.

PART-A **(20 Marks)**

1. a) Write about static force analysis. [2M]
   b) With neat sketches, explain the effect of gyroscopic couple on pitching of a ship. [2M]
   c) Define fluctuation of energy. [2M]
   d) List the advantages of turning moment diagram. [2M]
   e) List various types of the brakes. [2M]
   f) State the function of dynamometer. [2M]
   g) Explain the term hunting and sensitiveness of governor. [2M]
   h) Define Swaying Couple and Hammer Blow. [2M]
   i) Define critical speed of shaft. [2M]
   j) Write a short notes on dunkerley's method. [2M]

PART-B **(50 Marks)**

2. The mass of the turbine rotor of a ship is 8tonnes and the radius of gyration 0.6m. It rotates at 1800rpm clockwise when viewed from stern. Determine the gyroscopic effects in the following cases i) If the ship travelling at 100kmph steers to the starboard side in a curve of 75m radius. ii) If the ship is pitching and the bow is descending with maximum velocity, the periodic time is being 20seconds and the total angular movement between the extreme positions is 10^0. iii) If the ship is rolling at a certain instant has an angular velocity of 0.03rad/sec clockwise when looking from stern, In each case, explain clearly how you determine the direction in which the ship tends to move as a result of the gyroscopic action. [10M]

OR

3. Explain the effect of gyroscopic couple on aeroplane and naval ships. [10M]

4. The Turning-Moment diagram for a multi cylinder engine has been drawn to a scale of $1mm^2 = 5654.87$N-m and the intercepted areas with the mean torque line taken in order are +0.36, -0.81, +0.75, -0.64, +0.92, -0.58 mm^2. Mean speed of fly wheel is 150 rev/m and fluctuation of speed 2% of mean speed and density of fly wheel material 7260 kg/m^3 and mean peripheral speed is 1000m/min. Determine the diameter and the cross section of the rim. [10M]

OR

5. The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m ; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm^2. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m. [10M]

6. A simple band brake of drum diameter 600 mm has a band passing over it with an angle of contact of 225^0, while one end is connected to the fulcrum, the other end is connected to the brake lever at a distance of 300 mm from the fulcrum. The brake lever is 1meter long. The brake is to absorb a power of 45kW at 500 r.p.m. Determine the tangential force and tensions at both sides. [10M]

OR

7. A single block brake, the length of lever 400mm, distance between fulcrums to contact surface of brake drum 100mm and drum diameter 250mm. The angle of contact is 90^0 and the coefficient of friction between the drum and lining is 0.33. If the torque transmitted by the brake is 70N-m, Analyze the force P required to operate the brake. [10M]

8. The arms of a Porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of rotation of the balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the speed range of the governor. If the friction at the sleeve is equivalent of 20 N of load at the sleeve, determine how the speed range is modified. [10M]

OR

9. A,B,C and D are four masses carried by a rotating shaft at radii 100 mm, 125 mm, 200 mm and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively. Find the required mass 'A' and the relative angular settings of the four masses so that the shaft shall be in complete balance? [10M]

10. The moment of inertia of a three-rotor system A, B, and C are respectively 100, 225 and 20 kg-m^2. The distance between A and B is 100 cm and between B and C is 14.1 cm and the shaft is 8 cm diameter. If the modulus of rigidity of the shaft is 80 GN/ m^2, find the frequencies of the free torsional vibration of the system? [10M]

OR

11. Evaluate the critical speed of a shaft 20 mm in diameter and 0.6 m long carrying a mass of 1 kg at its mid-point. Assume the shaft is simply supported and it's Young's Modulus is 200 GN/m^2. [10M]

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