

Code No.: ME502PC

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**CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS**

**III-B.TECH-I-Semester End Examinations (Regular) - January- 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) With neat sketches, explain the effect of gyroscopic couple on pitching of a ship. [2M]
- b) Define D'Alembert's principle. [2M]
- c) Define fluctuation of energy and fluctuation of speed. [2M]
- d) List the functions of a flywheel. [2M]
- e) Write a short note on boundary friction. [2M]
- f) List various types of the brakes. [2M]
- g) Explain the term hunting and sensitiveness of governor. [2M]
- h) State the reason why the reciprocating masses are partially balanced. [2M]
- i) Write a short note on torsional vibration. [2M]
- j) Define in short, free vibrations and forced vibrations. [2M]

PART-B

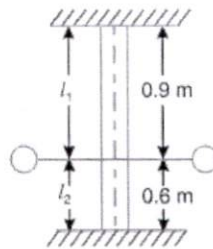
(50 Marks)

2. Explain the effect of gyroscopic couple on aeroplane and naval ships. [10M]
- OR**
3. The length of connecting rod of an engine is 500 mm (centre to centre) and its mass is 20 kg. The distance of centre of gravity is 125 mm from crank pin centre and crank radius is 100 mm. The radius of the small end pin is 30 mm. The frequency of oscillations of the rod when suspended from the small end is 45 cycles per minute. Determine dynamically equivalent system keeping one mass at the small end. [10M]
 4. The areas above and below the mean torque line for an I.C. engine are -25, +200, -100, +150, -300, +150 and -75 mm² taken in order. The scale for the turning moment diagram is 1 mm vertical scale = 10 Nm and 1 mm horizontal scale = 1.5°. The mass of the rotating parts are 45 kg with a radius of gyration of 150mm. If the engine speed is 1500 r.p.m., find the co-efficient of fluctuation of speed. [10M]
- OR**
5. a) Explain the terms 'fluctuation of energy' and 'fluctuation of speed' as applied to flywheels. [5M]
 - b) An engine flywheel has a mass of 6.5 tones and the radius of gyration is 2m. If the maximum and minimum speeds are 120 rpm and 118 rpm respectively. Find maximum fluctuation of energy. [5M]
 6. Explain briefly the uniform pressure theory and uniform wear theory as applicable to friction clutches. [10M]
- OR**
7. A band brake acts on the 3/4th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the i. anticlockwise direction, and ii. clockwise direction. [10M]

8. A Proell governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of each ball is 10 kg and the mass of the central load is 100 kg. Determine the range of speed of the governor. [10M]

OR

9. A four cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance. [10M]
10. A flywheel is mounted on a vertical shaft as shown in below fig. The both ends of a shaft are fixed and its diameter is 50 mm. The flywheel has a mass of 500 kg and its radius of gyration is 0.5 m. Find the natural frequency of torsional vibrations, if the modulus of rigidity for the shaft material is 80 GN/m^2 . [10M]



OR

11. Calculate 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 its Young's Modulus is 200 GN/m^2 . [10M]
