BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING) THIRD YEAR FIRST SEM [SUPPL.] EXAM 2024
Subject: **DYNAMICS OF MACHINES**

Time : Three hours   **Full Marks: 100**

Answer any 5 (five) questions

1a. What do you mean by 'Logarithmic Decrement'.
 b. What is 'Support Motion'. Explain the working principles of seismometer and accelerometer.   5+15

2a. Explain what is 'Damping Ratio'.
b. From the equation of motion of free vibration, derive expressions of overdamped, underdamped and critically-damped motions and explain those with suitable plots.   5+15

3. Four rotating eccentric masses m_1, m_2, m_3, m_4 are attached to a shaft at radius of r_1, r_2, r_3, r_4. Balance the system with the use of additional masses at appropriate radius and positions.
Given: m_1= 10 kg, m_2=5 kg, m_3= m_4=5 kg.
r_1= r_2= 5 mm, r_3= r_4= 4 mm.
Initial configuration: m_1 is horizontal towards right, m_2 is 150° apart from the same, m_3 is directed vertically downward, m_4 is further 60° apart from m_3.
Distance between m_1 & m_2 is 1 m, that between m_2 & m_3 is 2 m and that between m_3 & m_4 is 1.5 m.   20

4. From the equation of motion of viscously damped forced vibration, show the vector relationship and with the help of the same, solve the equation and show the curves of 'amplitude' and 'phase angle' with 'frequency ratio' for different 'damping ratios'. Explain the occurrence of resonance from the same.   15+5

5a. Find the expression for suitable cross sectional area of a flywheel used for an IC engine. Mention requisite assumption.
 b. From turning moment diagram of an IC engine, explain the co-efficient of fluctuation of energy and the co-efficient of fluctuation of speed.   10+10

6. A machine shaft running at a mean speed of 250 rpm requires a torque which increases uniformly from 7 kgm to 280 kgm during the first half revolution, remains constant for the following one revolution. It then decreases uniformly to 70 kgm during the next half revolution and remains constant for one revolution. The cycle is then repeated. If the torque applied to the shaft is constant and the flywheel has a mass of 450 kg with a radius of gyration of 600 mm, find,
a. the horse power necessary to drive the machine and
b. percentage fluctuation of speed.   20

7. In a turning moment diagram the areas above and below the main torque line taken in order are 5.81, 3.23, 3.87, 5.16, 1.94, 3.87, 2.58 and 1.94 sq.cm respectively. The scales of the turning moment diagram are:
Turning moment 1cm = 700kgf.m, crank angle 1cm=60degree
Mean speed of the engine is 120rpm and the variation of speed must not exceed ±3% of the mean speed. Assuming the radius of gyration of the flywheel to be 106.67cm, find the weight of the flywheel to keep the fluctuation of speed within the given limits.   20