Indian Maritime University

(A Central University, Govt of India)

September/October 2024 - Supplementary Examinations

Programme Name: B Tech (Marine Engineering)

Semester: IV

Subject Code: UG11T3403

Subject Name: MECHANICS OF MACHINES - II

Date: 06.09.2024	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. Which of the following statement is correct?

(A) In any engine, 100% of the reciprocating masses can be balanced dynamically

(B) In the case of balancing of multimass rotating systems, dynamic balancing can be directly started without static balancing done to the system

(C) In the case of balancing of multicylinder engine, the value of secondary force is higher than the value of the primary force

(D) none of the above

2. In order to have a complete balance of the several revolving masses in different planes

(A) the resultant force must be zero

(B) the resultant couple must be zero

(C) both the resultant force and couple must be zero

(D) none of the above

3. When there is a reduction in amplitude over every cycle of vibration, then the body is said to have

(A) free vibration (B) forced vibration

(C) damped vibration (D) All of the above

4. In under damped vibrating system, if x_1 & x_2 are the successive values of the amplitude on the same side of the mean position, then the logarithmic decrement is equal to

(A) $\frac{x_1}{x_2}$ (B) $\log\left(\frac{x_1}{x_2}\right)$

(C) $\log_e\left(\frac{x_1}{x_2}\right)$ (D) $\log(x_1 \times x_2)$

5. The equation of motion for a vibrating system with viscous damping is

$$\frac{d^2x}{dt^2} + \frac{c}{m} \times \frac{dx}{dt} + \frac{s}{m} \times x = 0$$

If the roots of this equation are real, then the system will be

(A) over damped (B) under damped

(C) critically damped (D) none of the above

6. The natural frequency (in Hz) of free longitudinal vibrations is equal to

(A) $\frac{1}{2\pi} \times \sqrt{\frac{s}{m}}$ (B) $\frac{1}{2\pi} \times \sqrt{\frac{g}{\delta}}$

(C) $\frac{0.4985}{\sqrt{\delta}}$ (D) All of the above

7. At a nodal point in a shaft, the amplitude of torsional vibration is

(A) Zero (B) Minimum

(C) Maximum (D) Negative

8. The factor which affects the critical speed of a shaft is

(A) diameter of the disc (B) span of the shaft

(C) eccentricity (D) All of these

9. The ratio of the maximum displacement of the forced vibration to the deflection due to the static force, is known as

(A) damping factor (B) damping coefficient

(C) logarithmic decrement (D) magnification factor

10. Longitudinal vibrations are said to occur when the particles of a body moves

(A) perpendicular to its axis (B) parallel to its axis

(C) in a circle about its axis (D) All of the above

Section B

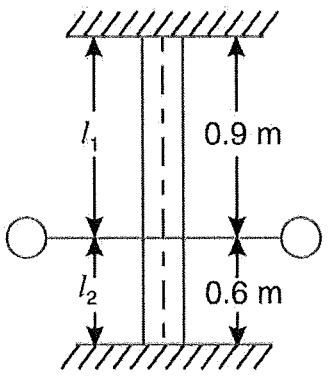
Five Questions of 02 Marks each

11. Why balancing of rotating parts is necessary for high-speed engines?
12. Define - Damped vibration
13. Write short note on vibration isolation
14. Explain logarithmic decrement
15. What is meant by magnification factor?

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. Use analytical or graphical (any one) method to solve the problem.
17. Derive an expression for the natural frequency of the free longitudinal vibrations using any one of the following methods (i) Equilibrium Method (ii) Energy Method or Rayleigh's Method
18. A flywheel is mounted on a vertical shaft as shown in fig. The both ends of the 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



19. Derive the expression for critical or whirling speed of shafts using suitable assumptions and diagrams

20. A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GN/m^2. Determine the frequency of longitudinal and transverse vibrations of the shaft.

21. Explain about i) under damped ii) over damped and iii) critically damped vibrations using suitable diagrams

22. A single cylinder vertical petrol engine of total mass 300 kg is mounted upon a steel chassis frame and causes a vertical static deflection of 2 mm. The reciprocating parts of the engine has a mass of 20 kg and move through a vertical stroke of 150 mm with simple harmonic motion. A dashpot is provided whose damping resistance is directly proportional to the velocity and amounts to 1.5 kN per metre per second.
Considering that the steady state of vibration is reached;
Determine: a) the amplitude of forced vibrations, when the driving shaft of the engine rotates at 480 rpm and
b) the speed of the driving shaft at which resonance will occur.