Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations – March/April 2025

Programme Name: B Tech (ME)

Semester: II

Subject Code: UG11T4204

Subject Name: Engineering Mechanics

Date: 18.03.2025	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. When the two ships are moving along inclined directions, then the time when the two ships will be closest together depends upon
   (a) velocity of one of the ships (b) velocity of both the ships
   (c) angle between the two directions (d) all of the above
2. The frequency of vibration in case of simple harmonic motion
   (a) means the number of cycles per second (b) represents time taken by the particle for one complete oscillation
   (c) depends upon its amplitude (d) is directly proportional to its beat
3. Theorem of perpendicular axis is used in obtaining the moment of inertia of a
   (a) triangular lamina (b) square lamina
   (c) circular lamina (d) semicircular lamina
4. If a body is in equilibrium. We may conclude that
   (a) No force is acting on the body (b) The resultant of all the forces acting on it is zero

(c) The moments of the forces about any point is zero

(d) Both (b) and (c)

5. A body is moving in a circular path with radius 'r'. The relation between its linear velocity 'v' & angular velocity 'ω'

(a) $v=r\omega^2$

(b) $v=\omega/r$

(c) $v=r/\omega$

(d) None of the Above

6. Which axial force is determined while analyzing a truss?

(a) compressive force

(b) tensile force

(c) both (a) and (b)

(d) none of the above

7. Which of the following statement is wrong?

(a) If two springs of stiffness s_1 and s_2 are arranged in series, then stiffness of the equivalent spring is $s_1 + s_2$

(b) The motion of a body from one extremity to another is known as beat

(c) A pendulum, which executes one beat per second is known as second's pendulum

(d) none of them

8. A circular hole of radius (r) is cut out from a circular disc of radius (2r) in such a way that the diagonal of the hole is the radius of the disc. The centre of gravity of the section lies at

(a) Centre of a disc

(b) Centre of the hole

(c) Somewhere in the disc

(d) Somewhere in the hole

9. The torque acting on a body of moment of inertia (I) and angular acceleration (α) is

(a) $I\alpha$

(b) $I\alpha^2$

(c) $0.5\ I\alpha$

(d) $0.5\ I\alpha^2$

10. The velocity ratio of a simple wheel and axle with D and d as the diameters of effort wheel and load axle is

(a) D + d

(b) D – d

(c) D × d

(d) D/d

Section B

Five Questions of 02 Marks each

11. State the mathematical expression for equivalent stiffness of helical springs connected in (a) series and (b) parallel using diagrams as required
12. Define Routh's Rule Write the statements of the Pappu's Guldinus Theorems of finding Moment of Inertia of an object
13. List the assumptions taken while finding out the forces in the members of a perfect frame
14. Differentiate between constant acceleration and variable acceleration using suitable diagrams
15. Define the terms (a) Angular Acceleration and (b) Angular Velocity

Section C

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

16. A flywheel rotates with a constant retardation due to braking. From t = 0 to t = 10 seconds, it made 300 revolutions. At time t = 7.5 sec, its angular velocity was 40 π rad/sec.

    Determine (i) value of constant retardation ; (ii) total time taken to come to rest and (iii) total revolutions made till it comes to rest.

17. Determine the forces in the members EF, CF, BC of the Truss shown in below Fig.1. using method of sections.

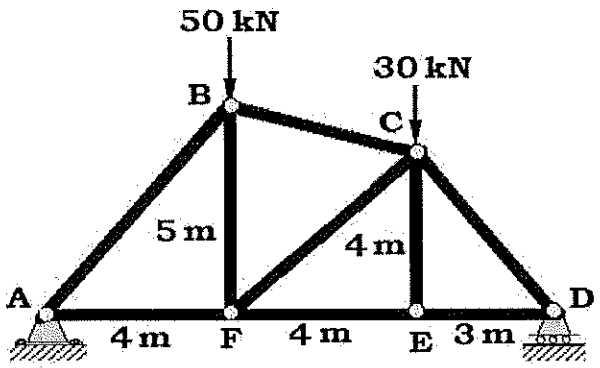

Fig.1

Determine the nature and magnitude of the forces in the members BC, GC and GF of the truss by using Method of Sections.

18. The law of a certain lifting machine is :

$$P = \frac{W}{50} + 8$$

The velocity ratio of the machine is 100. Find the maximum possible mechanical advantage and the maximum possible efficiency of the machine. Determine the effort required to overcome the machine friction, while lifting a load of 600 N. Also calculate the efficiency of the machine at this load.

19. Derive an expression for the frequency of motion for a Compound Pendulum in terms of radius of gyration 'k'

20. A motor car takes 10 seconds to cover 30 meters and12 seconds to cover 42 meters. Find the uniform acceleration of the car and its velocity at the end of 15 seconds.

21. State and derive the theorem of Parallel Axis for Moment of Inertia for a plane figure.

22. A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance, find:

a) The greatest elevation above the ground reached by the projectile; and

b) Horizontal distance from the gun to the point, where the projectile strikes the ground.

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