

Indian Maritime University
(A Central University, Govt of India)
Supplementary Examinations – March/April 2025
Programme Name: B Tech (NAOE/NASB)
Semester: 2nd Semester
Subject Code: UG12T2202 / UG13T1202
Subject Name: Applied Mechanics

Date: 08.03.2025

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. 'P' and 'Q' are two like parallel forces. If 'P' is moved parallel to itself through a distance of 4cm, then the resultant of 'P' and 'Q' moves through a distance of
(a) 2cm (b) 4cm (c) $\frac{4Q}{P+Q}$ cm (d) $\frac{4P}{P+Q}$ cm

2. The moment of a force about any point is geometrically equal to _____ the area of the triangle whose base is the line representing the force and vertex is the point about which the moment is taken.
(a) Half (b) Same (c) Twice (d) None of the above

3. The centroidal distance of semicircular arc from its base is
(a) r/π (b) $2r/\pi$ (c) $3r/\pi$ (d) $4r/\pi$

4. The moment of inertia of the circular section of diameter 'd' is
(a) $\pi d^4/8$ (b) $\pi d^4/16$ (c) $\pi d^4/32$ (d) $\pi d^4/64$

5. To solve a truss by the method of sections, the number of unknowns at a section should not be
(a) less than 2 (b) more than 2 (c) less than 3 (d) more than 3

6. According to principle of virtual work, "if a rigid body is in equilibrium the total virtual _____ of the external forces acting on the rigid body is zero for any virtual _____ of the body".
(a) work, displacement (b) work, force (c) displacement, force (d) force, work

7. A particle is at rest at the origin. It moves along the x-axis with an acceleration $(x - x^2)$, where 'x' is the distance of the particle at time 't'. The particle next comes to rest after it has covered a distance of
 (a) 1 (b) 1/2 (c) 3/2 (d) 2

8. When any two elastic bodies collide and move in the same direction, the velocity of separation is
 (a) independent of their initial velocities (b) difference of their initial velocities
 (c) sum of their initial velocities (d) average of their initial velocities

9. 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) both 'b' and 'c'

10. Range of a projectile motion of a particle with velocity 'u' and an angle 'α' with horizontal surface is
 (a) $\frac{u^2}{g}$ (b) $\frac{u^2 \sin 2\alpha}{g}$ (c) $\frac{2u \sin \alpha}{g}$ (d) $2\frac{u^2}{g}$

Section B

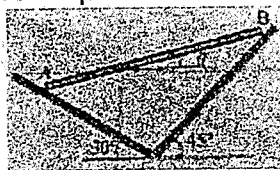
Five Questions of 02 Marks each

11. State the Varignon's principle of moments.
12. Define Pappus two theorems.
13. List out any two assumptions made to find out the forces in the members of a perfect truss.
14. Define Newton's first and second laws of motion.
15. Write down the equations of motion for radial and transverse forces.

Section C

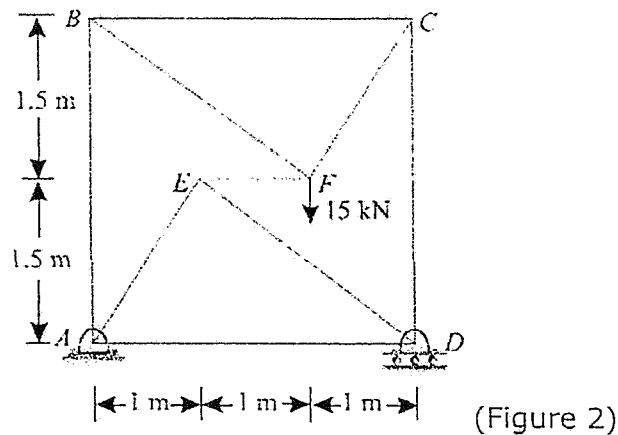
Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. A uniform rod AB is resting on two inclined smooth planes as shown in figure 1. Determine the angle θ for equilibrium.



(Figure 1)

17. A frame ABCD is hinged at A and supported on rollers at D as shown in figure 3. Determine the forces in the members AB, CD and EF by using method of sections.



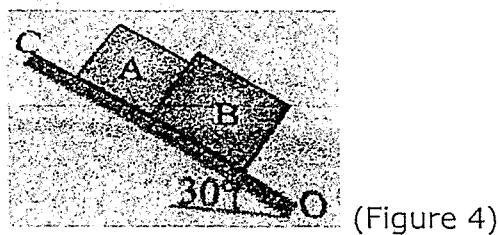
18. A beam of span 5 meters is carrying a point load of 2 kN at a distance 2 meters from the left end of the beam. Determine the beam reactions, by using the principle of the virtual work.

19. (a) State and explain D' Alembert's principle. (5M)

(b) A 20kg block is subjected to a force having a constant direction and a magnitude $F = 50x^2$, where x is in metres (Figure 4). Determine the speed of the block after it slides 3m. When $x=0$, the block is moving to the right at 2m/s. The coefficient of kinetic friction between the block and the surface is $\mu = 0.3$. (5M)



20. Two blocks A and B slide down the inclined plane OC that makes with horizontal an angle $\theta = 30^\circ$ as shown in figure 6. If the mass of the blocks $m_A = 20\text{kg}$ and $m_B = 40\text{kg}$ and the coefficients of friction between them and the inclined plane $\mu_A = 0.1$ and $\mu_B = 0.2$, find the reaction force between the blocks during the motion.



21. (a) Explain about Static Friction and Kinetic Friction in brief. (5M)

(b) The horizontal position of the 200kg rectangular block is adjusted by a 6° wedge under the action of a force P , as shown in figure 6. If the coefficient of friction for both the pairs of wedge surface is 0.25 and if the coefficient of friction between the block and the horizontal surface is 0.5, determine the least force P required to move the block. (5M)



22. Find the moment of inertia about the centroidal X-X axes (Horizontal) of the L-section, as shown in figure 6.

