

Indian Maritime University				
June 2022 End Semester Examinations				
B TECH (MARINE ENGINEERING)				
ENGINEERING MECHANICS				
UG11T4204				
Max Marks : 70	Pass Marks : 35			
Duration: 03 Hours	Date: 23.06.2022			
Part A (Part A is Compulsory)				
Q1 [10 x 1 = 10 Marks] Multiple Choice Questions	Options			
(I) The moment of inertia of a triangular section of base (b) and height (h) about an axis through its <i>c.g.</i> and parallel to the base is given by the relation.	A) $\frac{b \times h^3}{12}$	B) $\frac{b \times h^3}{24}$	C) $\frac{b \times h^3}{36}$	D) $\frac{b \times h^3}{48}$
(II) A weight of 1000 N can be lifted by an effort of 80 N. If the velocity ratio of the machine is 20, then the machine is	A) Reversible	B) Non-reversible	C) Ideal	D) None of the above
(III) The maximum mechanical advantage of	A) $1 + m$	B) $1 - m$	C) $\frac{1}{m}$	D) m

a lifting machine is				
(IV) Which of the following statement is wrong?	A) The matter contained in a body is called mass. revolving masses	B) The force with which a body is attracted towards the centre of the earth is called weight. the reciprocating masses	C) The total motion possessed by a moving body is called impulsive force of engines	D) none of them
(V) The periodic time of a body moving with simple harmonic motion	A) depends upon its amplitude under all conditions.	B) is independent of its amplitude	C) depends upon its amplitude under certain conditions	D) has no relation with its frequency.
(VI) The velocity of a particle moving with simple harmonic motion is maximum when its acceleration is	A) zero	B) maximum	C) average	D) both (a) and (b).
(VII) The maximum height of a projectile on a horizontal range is	A) $\frac{u^2 \sin(2\alpha)}{2g}$	B) $\frac{u^2 \sin(\alpha)}{2g}$	C) $\frac{u^2 \sin^2(2\alpha)}{2g}$	D) $\frac{u^2 \sin^2(\alpha)}{2g}$
(VIII) In a simple screw jack, with (l) as the length of the effort wheel and (p) as pitch of the screw, its velocity ratio is	A) $\frac{2\pi l}{p}$	B) $\frac{\pi l}{2p}$	C) $\frac{2\pi p}{l}$	D) $\frac{\pi p}{2l}$

(IX) 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 oscillati	C) depends upon its amplitude	D) is directly proportional to its beat.
(X) A couple consists of	A) A couple consists of	B) two like parallel forces of different magnitudes.	C) two unlike parallel forces of same magnitude	D) two unlike parallel forces of different magnitudes.

Q2 [2 x 5 = 10 Marks] - Short Answer Type Questions

- (I) State lame's theorem.
 (II) What is D'Alembert's principle
 (III) Describe horizontal range of projectile.
 (IV) State parallel axis theorem
 (V) Define amplitude and frequency of SHM

Part B (Answer any Five out of Seven) Each Question is for 10 Marks

3. Determine the force in each member of the truss shown below figure 16(a), and state if the members are in tension or compression. Set $\theta = 30^\circ$

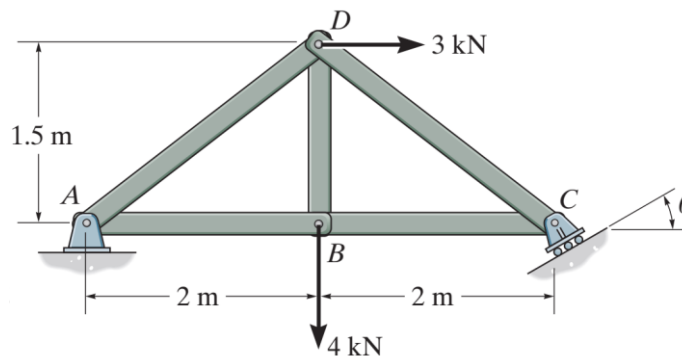


Figure 16(a)

4. Locate the centroid \bar{x} of the shaded area shown in figure 17(a). Locate the centroid (\bar{x}, \bar{y}) of the shaded area shown in figure 17(b).

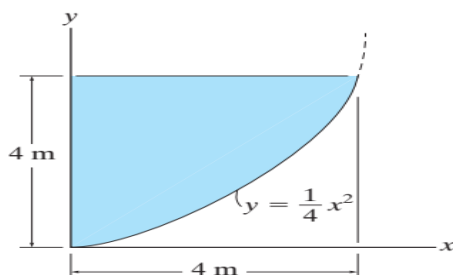


Figure 17(a)

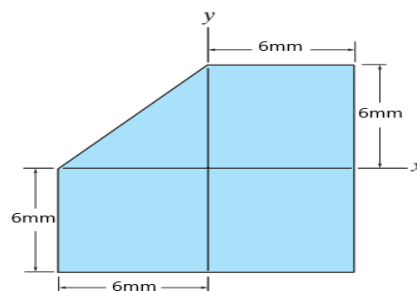


Figure 17(b)

5. Determine the polar moment of inertia of I-section shown in the figure 18(a)

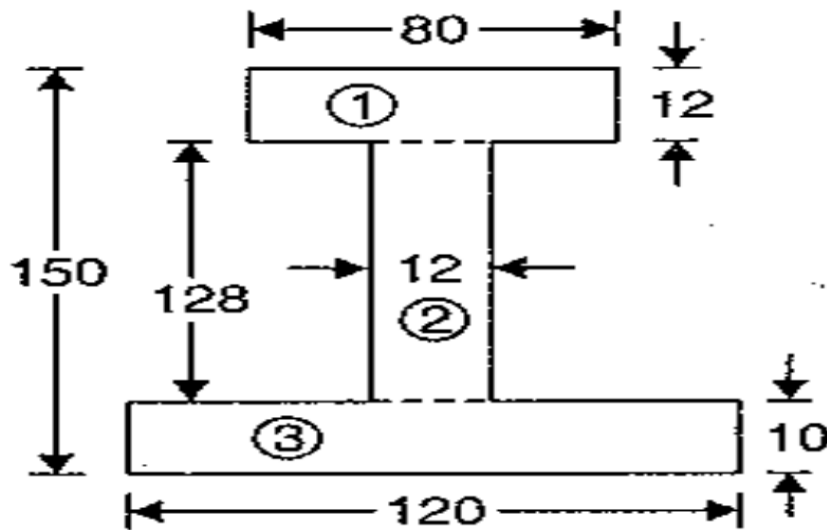


Figure 18(a)

6. A double purchase crab used in a laboratory has the following dimensions :

Diameter of load drum = 160 mm, Length of handle = 360 mm

No. of teeth on pinions = 20 and 30, No. of teeth on spur wheels = 75

and 90. When tested, it was found that an effort of 90 N was required to lift a load of 1800 N and an effort of 135 N was required to lift a load of 3150 N. Determine :

(a) Law of the machine,

(b) Probable effort to lift a load of 4500N

(c) Efficiency of the machine in the above case,

(d) Maximum efficiency of the machine.

7. A 50-kg block moves between vertical guides as shown in figure 20(a). The block is pulled 40 mm down from its equilibrium position and released. For each spring arrangement, determine the period of the vibration, frequency, the maximum velocity of the block, and the maximum acceleration of the block.

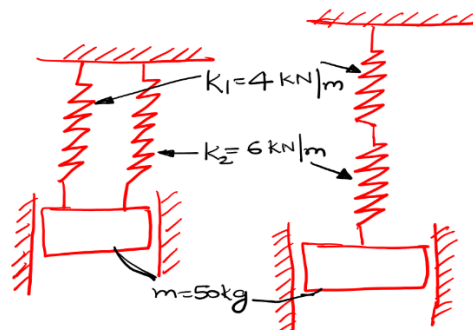


Figure 20 (a)

8. 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.

9. (a) The equation of motion of a particle moving in a straight line is given by : $s = 18t + 3t^2 - 2t^3$ where (s) is in metres and (t) in seconds. Find (i) velocity and acceleration at start, (ii) time, when the particle reaches its maximum velocity, and (iii) maximum velocity of the particle.

(b) A 50 kg mass block is placed on an inclined plane that makes an angle of 30° with respect to the horizontal plane with the coefficient of friction between block and the inclined plane is 0.2. Find the acceleration of the block.