# University of Mumbai

## Examination 2020 under cluster 03 (Lead College: FCRIT)

**Examinations Commencing from 22rd April 2021 to 30 th April 2021**

Program: First Year Engineering (All Branches)

Curriculum Scheme: Rev2019 C Scheme

Examination: FE Semester I

Course Code: FEC104 and Course Name: Engineering Mechanics

Time: 2 hour Max. Marks: 80

==========

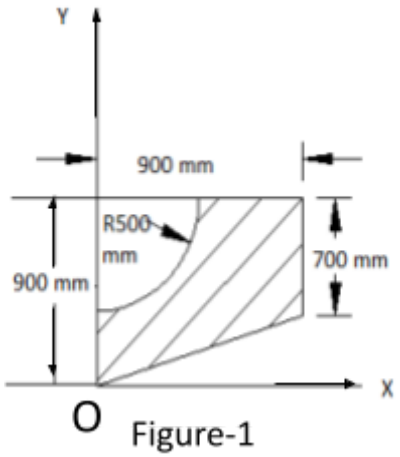
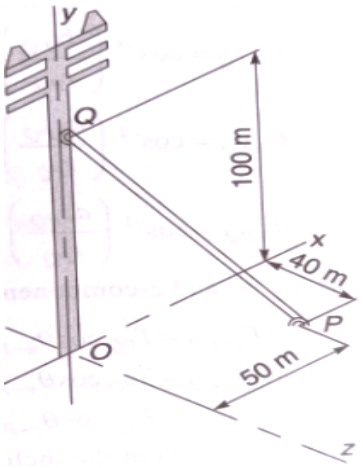
| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
|---|---|
| | |
| 1. | Equilibrium of a rigid body in statics refers to _____. |
| Option A: | Balance of forces in static condition |
| Option B: | Balance of forces and moments in static condition |
| Option C: | Balance of energy of body |
| Option D: | Balance of inertia force and inertia moments |
| | |
| 2. | Kinematics of rigid body is _____. |
| Option A: | Study of geometry of motion considering the cause of motion |
| Option B: | Study of external force acting on it without considering the geometry of motion |
| Option C: | Study of geometry of motion without considering the cause of motion |
| Option D: | Finding the reaction forces and the moments at the supports |
| | |
| 3. | Resultant of the forces $\boldsymbol{F_1}$= 30$\boldsymbol{i}$ +20$\boldsymbol{j}$ and $\boldsymbol{F_2}$= -20$\boldsymbol{i}$ +10$\boldsymbol{j}$ is _____. |
| Option A: | 31.62 N acting along 71.56° to the x-axis |
| Option B: | 31.62 N acting along 18.56° to the x-axis |
| Option C: | 3100 N acting along 71.56° to the x-axis |
| Option D: | 31.62 N acting along 18.43° to the x-axis |
| | |
| 4. | Pushing or pulling of a vehicle with same magnitude of force along the same line of action is an illustration of _____. |
| Option A: | Equilibrium |
| Option B: | Principle of transmissibility |
| Option C: | Newtons III law |
| Option D: | Newtons II law |
| | |
| 5. | A block of mass 30 kg is kept on a smooth inclined plane of 30° and is supported by a force F acting parallel to the plane. The magnitude of force is _____. |
| Option A: | 14.71 N |
| Option B: | 147.15 N |
| Option C: | 300 N |
| Option D: | 150 N |
| | |
| 6. | A rod PQ carries three loads of 40N, 70N, and 100 N at 30 mm, 90 mm and 160 mm respectively from point P. Neglecting weight of the rod, the position of resultant is _____away from point P. |

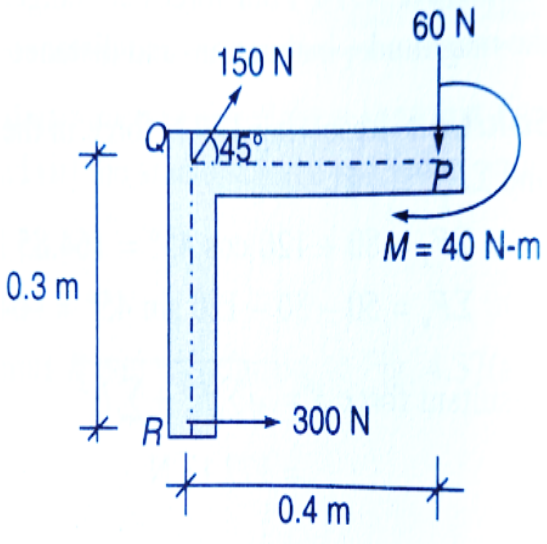
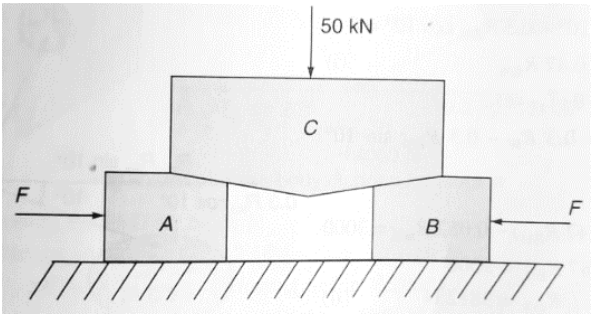
| | |
|---|---|
| Option A: | 11.19 mm |
| Option B: | 1.119 mm |
| Option C: | 111.9 mm |
| Option D: | 1119 mm |
| | |
| 7. | If the resultant of the two equal forces is equal to either of them, then angle between the forces is . |
| Option A: | 30º |
| Option B: | 60º |
| Option C: | 90º |
| Option D: | 120º |
| | |
| 8. | Ratio of limiting force of friction and normal reaction is . |
| Option A: | Coefficient of friction |
| Option B: | Angle of friction |
| Option C: | Sliding friction |
| Option D: | Coefficient of restitution |
| | |
| 9. | The minimum Force required to keep a body of mass 30 kg in equilibrium on an inclined plane ( plane is inclined 30º to horizontal), if the coefficient of Friction is 0.2, is ----------. ( Force applied is parallel to inclined plane). |
| Option A: | 198.124 N |
| Option B: | 161.823 N |
| Option C: | 96.176 N |
| Option D: | 147.15 N |
| | |
| 10. | A 2 m long ladder rests against a wall and makes an angle 30º with the horizontal. At the instant of slipping, the instantaneous center of rotation will be . |
| Option A: | 1.732 m from wall and 1m above the floor |
| Option B: | 1.732 m from wall and 4 m above the floor |
| Option C: | 1.732 m from wall and 2 m above the floor |
| Option D: | 1.732 m from wall and 3 m above the floor |
| | |
| 11. | When body slides down an inclined surface, the acceleration of body is given by . |
| Option A: | g |
| Option B: | g sinΘ |
| Option C: | g cosΘ |
| Option D: | g tanΘ |
| | |
| 12. | During the flight of projectile, which of the following remains constant? |
| Option A: | Angle of projection |
| Option B: | Horizontal component of velocity |
| Option C: | Vertical component of velocity |
| Option D: | Sum of kinetic and potential energy |
| | |
| 13. | A particle experiences constant acceleration for 25 s after starting from rest. If it travels a distance of $S_1$ in the first 15 s and distance $S_2$ in the next 10 s then, |
| Option A: | $S_1 = 1.78\,S_2$ |

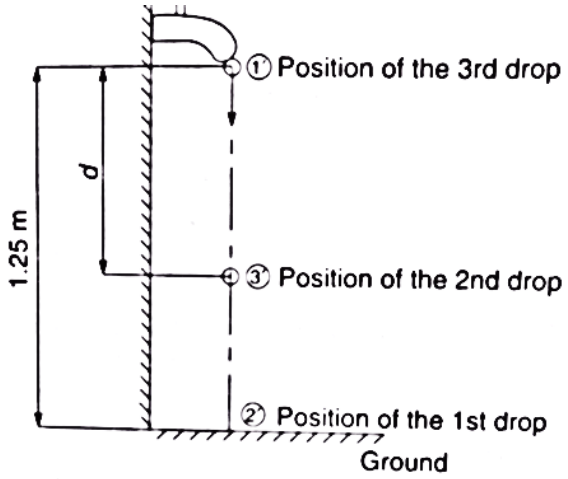
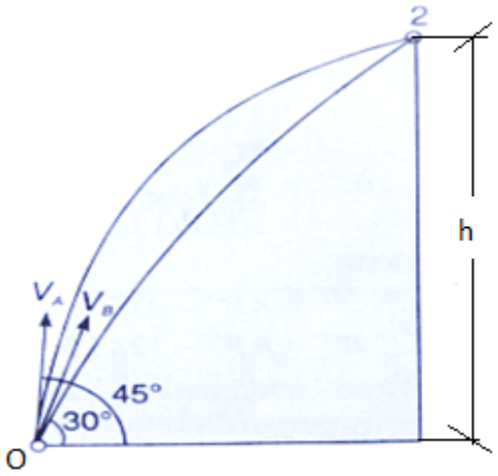
| | |
|---|---|
| Option B: | $S_2 = 1.78\, S_1$ |
| Option C: | $S_1 = S_2$ |
| Option D: | $S_2 = \frac{S_1}{0.78}$ |
| | |
| 14. | A person walks through the sides of a square field. Each side is 15 m long. Find the maximum magnitude of the displacement of the person in any time of interval. |
| Option A: | 15 m |
| Option B: | $15\sqrt{2}$ m |
| Option C: | 30 m |
| Option D: | 7.5 m |
| | |
| 15. | A particle dropped from a tower and it travels a distance of "y" in the first second. The distance travelled in the fourth second is _____. |
| Option A: | 7y |
| Option B: | 3.5y |
| Option C: | 14y |
| Option D: | y |
| | |
| 16. | If stone is projected vertically up, its time of flight is -. |
| Option A: | Inversely proportion to its mass |
| Option B: | Proportional to its initial velocity |
| Option C: | Proportional to its mass |
| Option D: | Inversely proportional to its initial velocity |
| | |
| 17. | Velocity-time curve for the body projected vertically upwards is a . |
| Option A: | Straight line inclined to the time axis |
| Option B: | parabola |
| Option C: | ellipse |
| Option D: | curve |
| | |
| 18. | A train passes over a 600 m long bridge. If the speed of the train is 30 /s and the train takes 30 s to cross the bridge, the length of the train is_____. |
| Option A: | 900 m |
| Option B: | 600 m |
| Option C: | 150 m |
| Option D: | 300 m |
| | |
| 19. | The area under the speed -time graph gives the . |
| Option A: | Change in displacement of the particle |
| Option B: | Change in Velocity of the particle |
| Option C: | Acceleration of the particle |
| Option D: | Momentum of particle |
| | |
| 20. | The point at which the total area of a plane figure is assumed to be concentrated is called_____. |

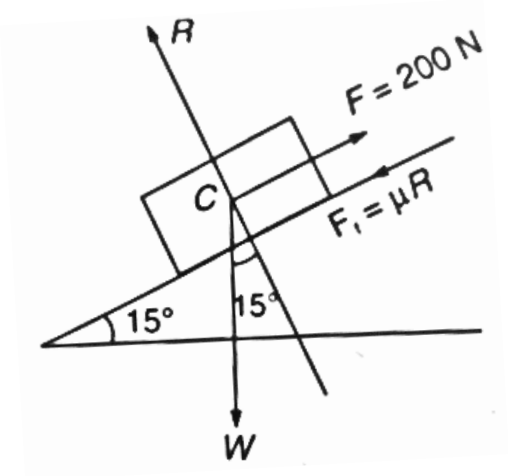
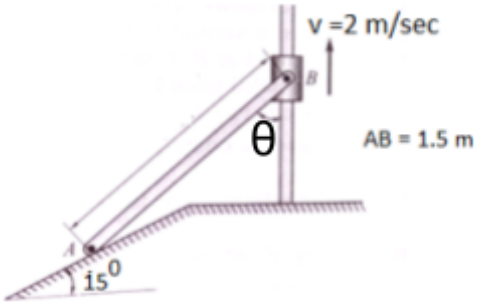
| | |
|---|---|
| Option A: | Centre of gravity |
| Option B: | Central point |
| Option C: | Centroid |
| Option D: | Inertial point |

## Descriptive Section

| **Q 2** | **20 Marks** |
|---|---|
| **A** | **Solve any Two from three** **2x5 = 10 M** |
| i. | Locate the centroid of the shaded area shown in the figure below.<br>  <br><br>Figure-1 |
| ii. | The guy wire of a pole is anchored by means of a bolt at a point P as shown in figure 2. The force in the wire is 100 kN. Determine (i) the component of the force in the x,y, z directions and (ii) the direction of the force.<br>  <br><br>Figure-2 |
| iii. | Figure 3 shows an angle bracket applied with three forces and couple of magnitude 40 N-m at point A.<br>(i) Find resultant of the system of forces.<br>(ii) Locate the position of the line of action of the resultant force with reference to the lines PQ and QR. |

| | |
|---|---|
| |  <br>Figure 3 |
| **B** | **Solve any One from the following** **10 marks** |
| **i.** | Find the force F on wedges A and B as shown in Figure 4, necessary to raise the weight of 50 kN acting on block C. Assume that the coefficient of friction between all contact surface is 0.22. The inclination of inclined face of wedge is 15°.<br>  <br>Figure 4 |
| ii. | Two objects A and B are dropped from the top of a tower of height "h" at different time intervals and reach the ground in $t_1$ seconds and $t_2$ seconds, respectively. Find the ratio of $t_1$ and $t_2$ if the object A travels 50 m in its last second of flight, while object B travels 70 m in its last second of flight? |

| Q 3 | 20 Marks |
|---|---|
| **A** | **Solve any Two out of three from the following 2*5 = 10Marks** |
| i. | Water drops fall at regular interval from a tap which is 1.25 m above the ground. When the third drop leaving the tap, the 1st the drop touches the ground. Find the position of the second drop below the tap at that instant.   Figure 5 |
| ii. | The motion of particle is defined by the realtion $x = 3t^3 - 18t^2 + 26t + 8$, where x is the position expressed in meters and t is the time in seconds. Determine<br>(i) time when the velocity is zero and<br>(ii) the position and the total distance travelled when the acceleration becomes zero. |
| iii. | Two stones A and B are projected from the same point at $45°$ *and* $30°$ respectively, inclined to the horizontal. Find the ratio of the velocities of A and B if the maximum height reached by both is the same. (Refer the figure-6)   Figure 6 |
| B | **Solve any One 10 marks** |
| i. | A force of 200 N is required to drive a body up an inclined plane of angle 15°, the force being parallel to the plane. If the angle of inclination of the plane is made 20°, the force |

| | |
|---|---|
| | required, again parallel to the plane, is found to be 230 N. Find the weight of the body and the coefficient of friction. (Refer Figure-7)<br>  <br><br>Figure 7 |
| ii. | Figure 8 shows a collar B which moves upwards with a constant velocity of 2 m/sec. At the instant when $\theta = 40°$, detrmine<br>(i) the angular velocity of rod AB which is pinned at B and freely resting at A against 15° slopping round<br>(ii) the velocity of end A of the rod<br>(iii) the velocity of midpoint C of the rod AB.<br>  <br><br>Figure 8 |

# University of Mumbai

## Examination 2020 under cluster 03 (Lead College: FCRIT)

**Examinations Commencing from 22rd April 2021 to 30 th April 2021**

Program: First Year Engineering (All Branches)

Curriculum Scheme: Rev2019 C Scheme

Examination: FE Semester I

Course Code: FEC104 and Course Name: Engineering Mechanics

Time: 2 hour Max. Marks: 80

==========

| Question Number | Correct Option (Enter either 'A' or 'B' or 'C' or 'D') |
|---|---|
| Q1. | B |
| Q2. | C |
| Q3. | A |
| Q4 | B |
| Q5 | B |
| Q6 | C |
| Q7 | D |
| Q8. | A |
| Q9. | C |
| Q10. | A |
| Q11. | B |
| Q12. | B |
| Q13. | B |
| Q14. | B |
| Q15. | A |
| Q16. | B |
| Q17. | A |
| Q18. | D |
| Q19. | A |
| Q20. | C |