

**University of Mumbai**

Curriculum Scheme: Rev2019

**All Programs**

Examination: FE Semester I FH2022

Course Code: FEC104

Course Name: Engineering Mechanics

Time: 2.5 hours

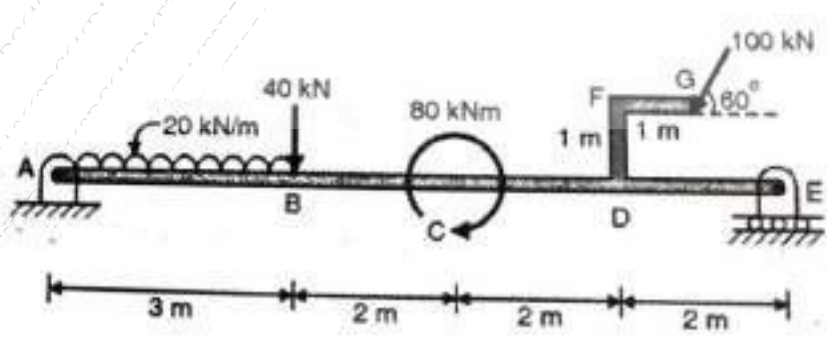
Max. Marks: 80

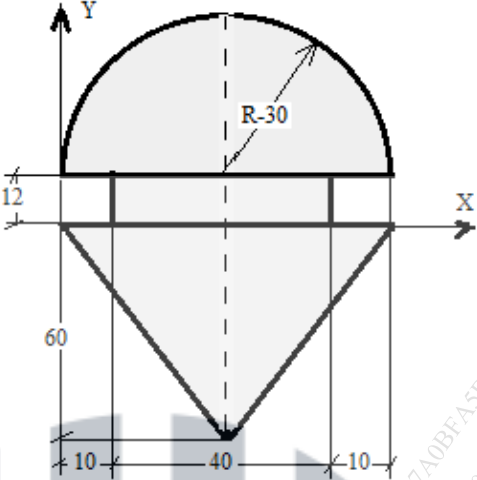
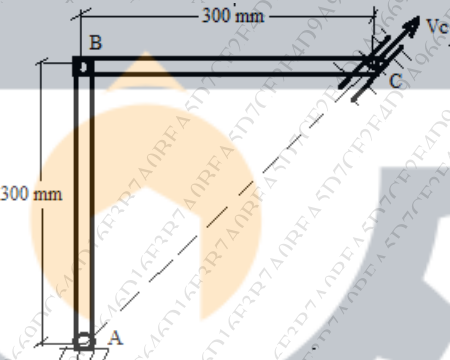
Instructions :1. All the questions are compulsory.

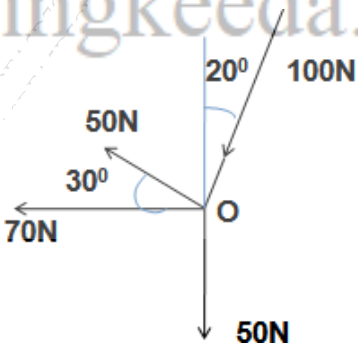
2. Each questions carry equal marks.

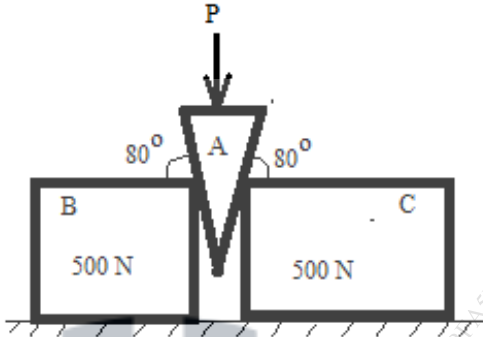
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| <b>Q1.</b> | <b>Choose the correct option for following questions. All the Questions are compulsory and carry 2 marks each</b> |
| 1.         | Pushing or pulling of a vehicle with same magnitude of force along the same line of action is called as _____.    |
| Option A:  | Equilibrium                                                                                                       |
| Option B:  | Principle of transmissibility                                                                                     |
| Option C:  | Newtons III law                                                                                                   |
| Option D:  | Newtons II law                                                                                                    |
| 2.         | Ratio of limiting friction and normal reaction is _____.                                                          |
| Option A:  | Coefficient of friction                                                                                           |
| Option B:  | Angle of friction                                                                                                 |
| Option C:  | Sliding friction                                                                                                  |
| Option D:  | Coefficient of restitution                                                                                        |
| Q3.        | Any lamina when hangs freely at any corner of the lamina, then the vertical line .....                            |
| Option A:  | Will pass through bottom left corner                                                                              |
| Option B:  | Will pass through bottom right corner                                                                             |
| Option C:  | Will pass through the centroid of a lamina.                                                                       |
| Option D:  | Will never pass through the centroid of a lamina.                                                                 |
| Q4.        | Conditions of equilibrium for coplanar concurrent force system are....                                            |
| Option A:  | 2                                                                                                                 |
| Option B:  | 3                                                                                                                 |
| Option C:  | 0                                                                                                                 |
| Option D:  | All above                                                                                                         |
| Q5.        | Where we apply Varignon's Theorem...                                                                              |
| Option A:  | To find magnitude of Resultant force.                                                                             |
| Option B:  | To find magnitude of Equilibrant force                                                                            |
| Option C:  | To find direction of resultant and equilibrant force.                                                             |
| Option D:  | None of above three                                                                                               |

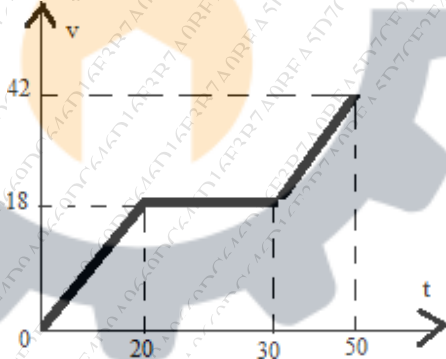
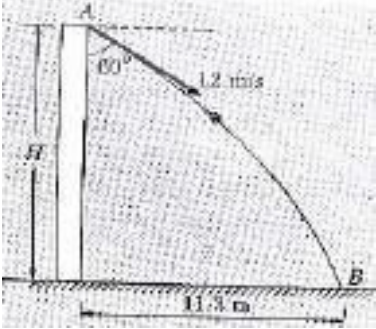
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| Q6.       | Equilibrant force is always....                                                                           |
| Option A: | Equal in magnitude, opposite in direction and collinear with Resultant force.                             |
| Option B: | Equal in magnitude, direction and collinear with Resultant force.                                         |
| Option C: | Equal in magnitude, opposite in direction and parallel with Resultant force.                              |
| Option D: | None of above three.                                                                                      |
| Q7.       | Two parallel equal forces acting in the opposite direction                                                |
| Option A: | balance each other                                                                                        |
| Option B: | constitute a moment                                                                                       |
| Option C: | constitute a force couple system                                                                          |
| Option D: | constitute a moment of the couple                                                                         |
| Q8.       | 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                                                            |
| Q9.       | 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                                                                                                     |
| Q10.      | Two force member is a ....                                                                                |
| Option A: | Member which is connected at the ends, consider weightless and no external force acts along the member.   |
| Option B: | Member which is connected anywhere; consider its own weight and no external force acts along the member.  |
| Option C: | Member which is connected at the ends, consider its own weight and external forces acts along the member. |
| Option D: | All above are correct.                                                                                    |

|           |                                                                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Q2</b> | <b>Solve any Two. [10 marks each]</b>                                                                                                                             |
| A         | Find the reactions at the supports A & B for the given beam shown in fig.<br> |

|   |                                                                                                                                                                                                                                                                                                        |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B | <p>Find the centroid of the shaded area shown in fig. with respect to given reference axes X &amp; Y.</p>                                                                                                            |
| C | <p>Collar C moves with constant velocity of <math>V_C = 1.2 \text{ m/s}</math> up the incline, as shown in fig. Determine angular velocity of the link AB and BC and velocity of point B at the instant shown.</p>  |

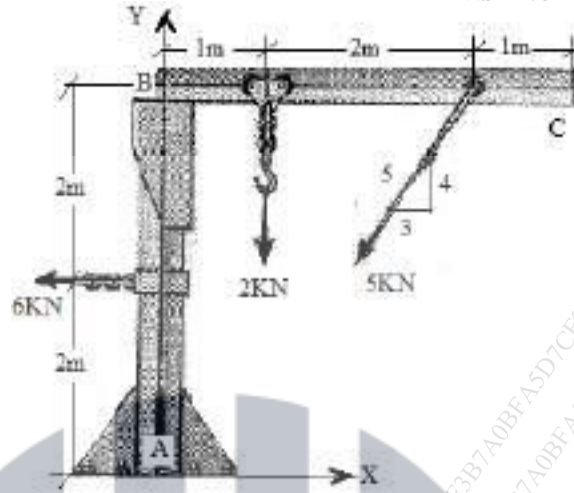
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| Q3. | <p>Solve any Two. [10 marks each]</p>                                                                                                                                                                                       |
| A   | <p>A concurrent system of forces is shown in the Error! Reference source not found.' Find the resultant passing through the origin</p>  |

|          |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>B</b> | <p>A wedge 'A' of negligible weight is to be driven between two 500 N blocks B and C. Knowing that the coefficient of friction is 0.35 between the blocks and the horizontal surface and zero between the wedge and each of the block ,Determine the force P required to start moving wedge if the blocks are equally free to move.</p>  |
| <b>C</b> | <p>A stone is thrown vertically upward with a velocity 20 m/s while coming down it strikes a glass pan held half the height through which it has rises and losses half of its velocity in breaking the glass. Find the velocity of stone with which it strikes the ground.</p>                                                                                                                                             |

|            |                                                                                                                                                                                                                                                                                                                                                                           |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Q4.</b> | <p><b>Solve any Two. [10 marks each]</b></p>                                                                                                                                                                                                                                                                                                                              |
| <b>A</b>   | <p>The race car starts from rest and travels along a straight road until it reaches a speed of 42 m/s in 50 sec. as shown by v-t graph. Determine the distance travelled by race car in 50 sec. draw x-t and a-t graph.</p>                                                           |
| <b>B</b>   | <p>A ball thrown with a speed of 12m/s at an angle of <math>60^\circ</math> with a building strikes the ground 11.3m horizontally from the foot of the building as shown in fig. Determine the height of the building and the velocity of ball with which it strikes the ground.</p>  |

C

The jib crane shown in fig is subjected to three coplanar forces. Replace this loading by an equivalent resultant force and specify where the resultant's line of action intersects the column AB and boom BC.



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