

## COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

### B.TECH. DEGREE I SEMESTER REGULAR/SUPPLEMENTARY EXAMINATION IN MARINE ENGINEERING MAY 2021

#### 19-208-0104 ENGINEERING MECHANICS (2019 Scheme)

Time: 30 Minutes [for Answering and Scanning/Uploading the page of the Answer Sheet]

Max. Marks: 9

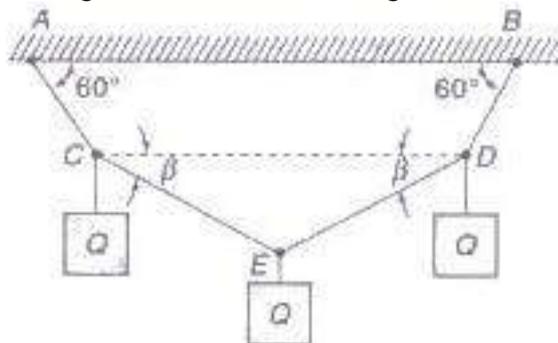
#### INSTRUCTIONS

1. You have to be available in Google Meet Video Camera throughout the examination hours.
2. Those students who are not present through Google Meet Video Camera will not be permitted to write the online examination.
3. You have to share your 'live location' to the faculty before uploading the answer sheet.
4. You have to answer only one question.
5. You have to write register number, subject code and module/group number (as given in the question paper) in each page.
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#### MODULE - I

(Answer **ANY ONE** question)

- I(1). On the string ACEDB are hung three equal weights  $Q$  symmetrically placed with respect to the vertical line through the mid-point  $E$ . Determine the value of the angles  $\beta$  if the other angles are as shown in the figure below. (9)

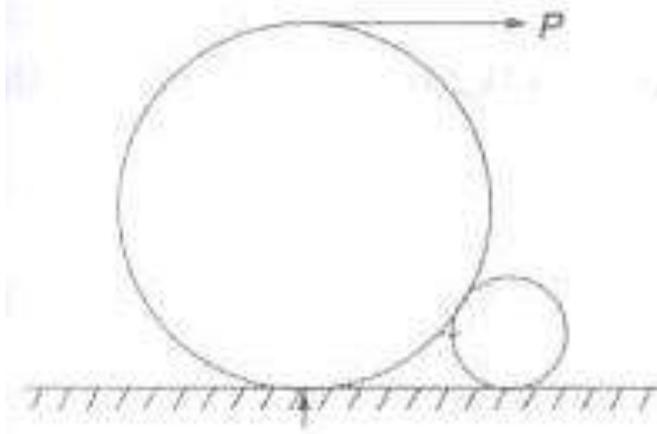


OR

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(2)

- I(2). Two heavy right circular rollers of diameters  $D$  and  $d$ , respectively, rest on a rough plane as shown in figure below. The larger roller has a string wound around it to which a horizontal force  $P$  can be applied as shown. Assuming that the coefficient of friction  $\mu$  has the same value for all surfaces of contact, determine the necessary condition under which the large roller can be pulled over the small one. (9)



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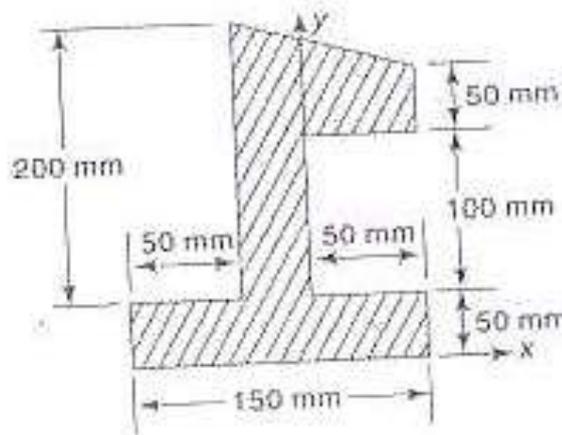
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#### MODULE - II

(Answer *ANY ONE* question)

- II(1). With reference to the coordinate axes  $x$  and  $y$ , find the moment of inertia of the shaded area of the plane figure shown below about its centroidal  $x$  axis. (9)

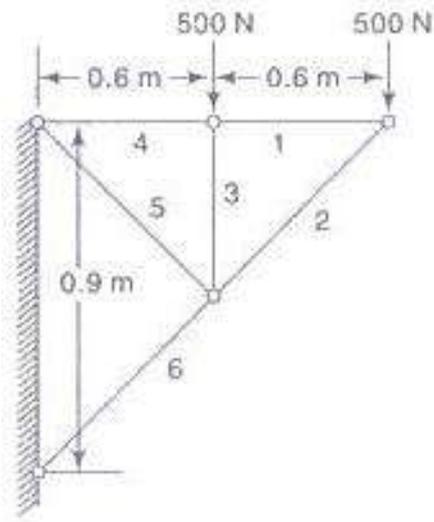


OR

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(2)

II(2). Determine the axial force in each bar of the plane truss loaded as shown in figure below. (9)



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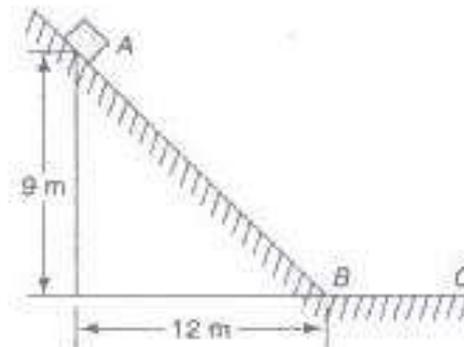
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#### MODULE - III

(Answer *ANY ONE* question)

- III(1). A small block starts from rest at point A and slides down the inclined plane AB as shown in the figure below. What distances along the horizontal plane BC will it travel before coming to rest? The coefficient of kinetic friction between the block and either place is  $\mu = 0.3$ . Assume that the initial velocity with which it starts to move along BC is of the same magnitude as that gained in sliding from A to B. (9)

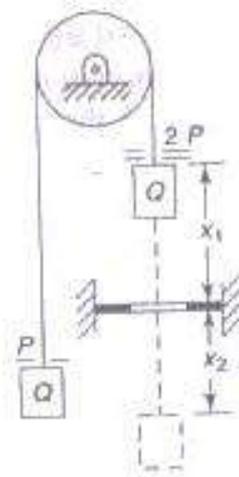


OR

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(2)

- III(2). If the system given in the figure below is released from rest in the configuration shown by solid lines, find the maximum distance  $h$  that the weight  $P$  will fall. Neglect friction and assume that the pulleys  $A$  and  $B$  are very small. (9)



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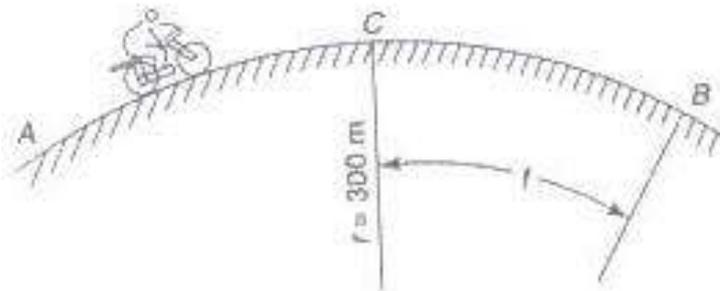
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**MODULE - IV**

(Answer **ANY ONE** question)

- IV(1). A motorcycle and rider of total weight  $W = 3000 \text{ N}$  travel in a vertical plane with constant speed  $v = 72 \text{ kmph}$  along the circular curve AB of radius  $r = 300 \text{ m}$ , as shown in figure below. Find the reaction  $R$  exerted on the motorcycle by the track as it passes the crest C of the curve. (9)

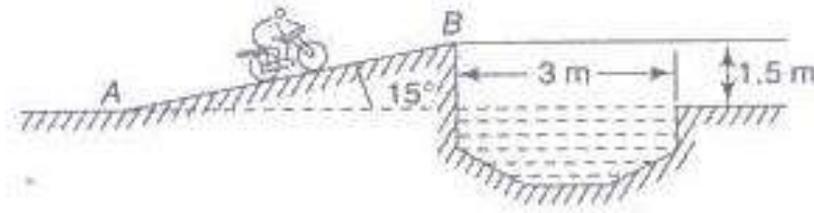


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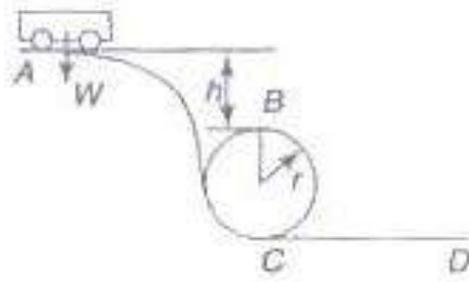
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(2)

- IV(2). (a) Referring to figure below, calculate the minimum speed  $v_0$  with which a motorcycle stunt rider must leave the  $15^\circ$  ramp at B in order to clear the ditch. (9)



- (b) A small car of weight  $W$  starts from rest at A and rolls without friction along the loop ACBD as shown in the figure below. What is the least height  $h$  above the top of the loop at which the car can start without falling off the track at point B, and for such a starting position what velocity will the car have along the horizontal portion CD of the track. Neglect friction.



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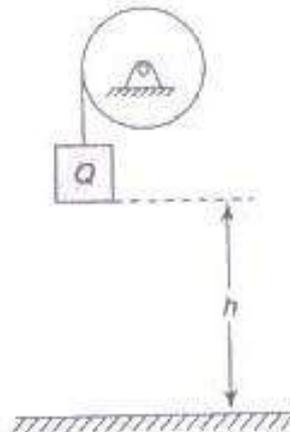
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**MODULE - V**

(Answer **ANY ONE** question)

- V(1). A solid right circular drum of radius  $r = 0.3$  m and weight  $W = 150$  N is free to rotate about its geometric axis as shown in figure below. Wound around the circumference of the drum is a flexible cord carrying at its free end with a weight  $Q = 50$  N. If the weight  $Q$  is released from rest, (i) find the time  $t$  required for it to fall through the height  $h = 3$  m. (ii) With what velocity  $v$  will it strike the floor. (9)

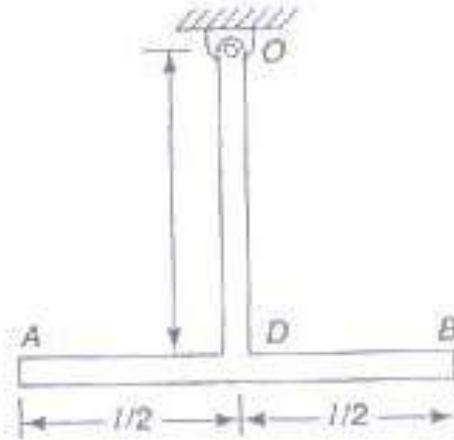


**OR**

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(2)

- V(2). Develop a formula for the period  $\tau$  for small oscillations of the compound pendulum shown in figure below. Treat OD and AB as identical slender bars of uniform cross-section. (9)



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