University of Mumbai

Curriculum Scheme: Rev2016

All Programs

Examination: FE Semester I _FH2022

Course Code: FEC104   Course Name: ENGINEERING MECHANICS
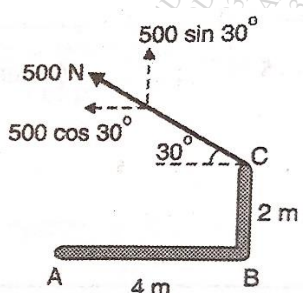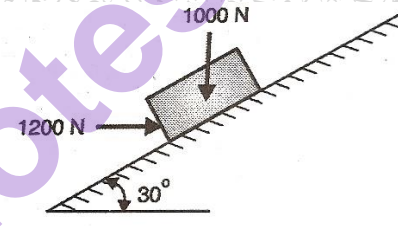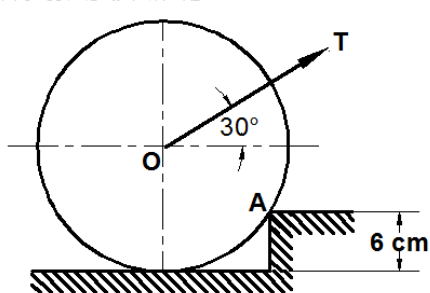Time: 2 hour 30 minute   <mark>Max. Marks: 80</mark>

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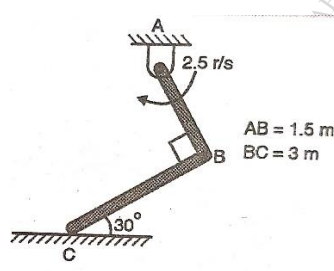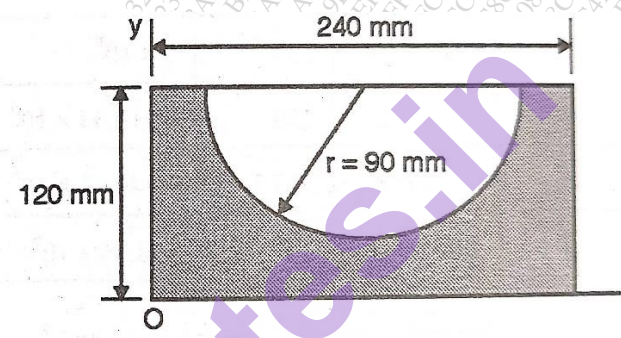
R2016_FE_I_FEC104_QP2

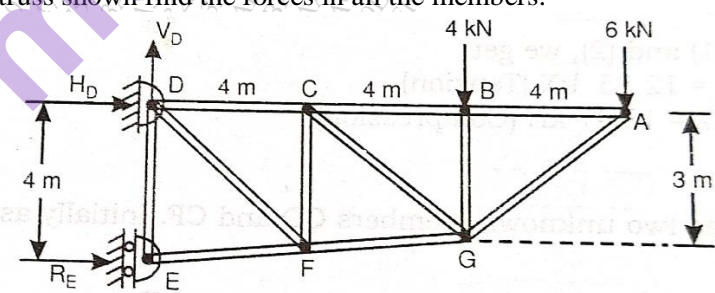| Q 1	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks [20]
1	Two parallel equal forces acting in the opposite direction
Option A:	balance each other
Option B:	constitute a moment
Option C:	constitute a force couple system
Option D:	constitute a moment of the couple
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
3.	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
4	The area under the speed -time graph gives the_____.
Option A:	Distance travelled by the particle
Option B:	Velocity of the particle
Option C	Acceleration of the particle
Option D:	Momentum of particle
5.	Which of the following statements describes the resultant of two forces?
Option A:	Force that maintains the system in equilibrium
Option B:	Force that has the highest magnitude in the system
Option C:	Force that has the same effect as the two forces
Option D:	Force that has the same effect as one force

6.	Varignon's theorem is used to find _____
Option A:	direction of resultant force
Option B:	location of resultant force
Option C:	magnitude of resultant force
Option D:	nature of resultant force
7.	If an object is dropped from the top of a building and it reaches the ground at t = 4 s , then the height of the building is (ignoring air resistance) (g = 9.8 m/s^2)
Option A:	77.3 m
Option B:	80.5 m
Option C:	79.2 m
Option D:	78.4 m
8.	D' Alembert's principle is used for
Option A:	Reducing the problem of kinetics to equivalent statics problem
Option B:	solving kinematic problems
Option C:	Stability of floating bodies
Option D:	Designing safe structures
9.	What is a free-body diagram?
Option A:	It's a sketch of a moving body that shows internal forces of the body and reaction forces
Option B:	It's a sketch of an undisturbed body that shows external forces of the body
Option C:	It's a sketch of an isolated body that shows external forces of the body and reaction forces
Option D:	It's a sketch of a body in motion that shows bending forces of the body
10.	Which of the following doesn't affect frictional force?
Option A:	Surface roughness
Option B:	Reaction of surface
Option C:	Area of contact
Option D:	Force tending cause motion

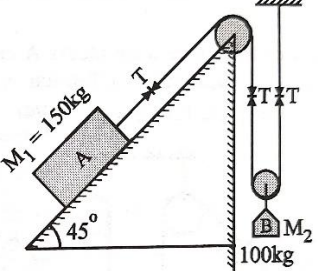| Q 2 | Solve any four questions out of six | 5 marks each |
20 marks		
a	Replace the following force system by a force couple system (i) at point A. (ii) at point B 	
b	If a horizontal force of 1200 N is applied to block of 1000 N, then block will be held in equilibrium or slide down or move up? Take $\mu= 0.3$ 	
c	A heavy roller with radius 14 cm and weighing 2000 N is pulled to the right by a pulling force T acting at an angle 30° with respect to horizontal as shown in figure. A 6 cm step stops the rolling motion of the roller. Find the magnitude of force T, to just start the motion of the roller. 	

d	At the instant shown in the figure, the rod AB is rotating clockwise at 2.5 rad/sec. If the end C of the rod BC is free to move on a horizontal surface find the angular velocity of rod BC and the velocity of its end point C. A 2.5 r/s AB = 1.5 m BC = 3 m B 30° C
e	A particle moves in a circular path of 9m radius, calculate after 4 seconds the particles total acceleration and distance travelled if speed is constant at 3 m/s.
f	Locate the centroid of the shaded area w.r.t 'O' y 240 mm r = 90 mm 120 mm O

Q 3 **20 marks**	**Solve any two questions out of three**	**10 marks each**
a	For the truss shown find the forces in all the members. V_D 4 kN 6 kN H_D D 4 m C 4 m B 4 m A 4 m 3 m R_E E F G	
b	A ball rebounds at A and strikes inclined plane at point B at a distance of 76 m as shown in fig. If the ball rises to a maximum height h= 19m above the point of projection, compute the initial velocity and the angle of projection α.	

c	Two cylinders are kept in a channel as shown in fig. Determine the reactions at all the contact points A, B , C and D. Assume all surfaces smooth

Q 4 (A) **10 Marks**	**Solve any two questions out of three** **5 marks each**
1	Three concurrent forces P= 150 N , Q= 250 N, and S = 300 N are acting at 120° with each other. Determine their resultant force magnitude and direction with respect to P. What is their equilibrant?
2	Force 5 kN is acting along AB where A (0,0,-1)m and B (5,-2,-4)m. Another force 8 kN is acting along BC where C(3,3,4)m, Find resultant of two forces and find moment of resultant force about a point D (0,3,-2)
3	A particle is projected with an initial velocity of 2 m/s along a straight line. The relation between acceleration and time is given in the diagram. Draw v-t diagram.

Q 4 (B) 10 marks	Solve any one question out of two 10 marks each
1	.A block of mass M_1 = 150 kg resting on inclined plane is connected by a string with another block of mass M_2 = 100 kg as shown in fig. If μ = 0.2 find acceleration of A and tension in the string.
2	If the 20 kg cylinder is released from rest at h = 0 , determine the required stiffness k of each spring so that its motion is momentarily stops when h = 0.5 m. Each spring has unstretched length of 1m. Refer fig.