Registration No :

Total Number of Pages : 05   **B.Tech**
15BE2104

1st Semester Back Examination 2018-19
MECHANICS
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL,
CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC,
MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC,
TEXTILE
Time : 3 Hours
Max Marks : 100
Q.CODE : E905
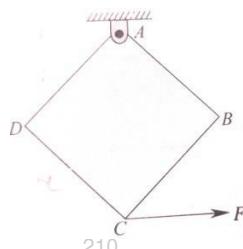**Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two**
from Part-III.
The figures in the right hand margin indicate marks.

Part- I
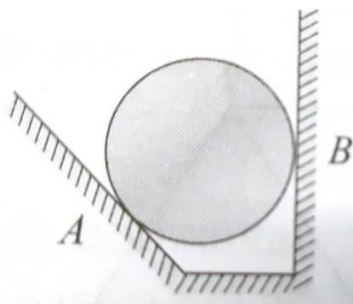**Q1**   **Short Answer Type Questions (Answer All-10)**   **(2 x 10)**
a)

A homogeneous square plate of 2kg mass is suspended in the figure as shown. Determine the horizontal force F required to be applied at corner C to keep the plate in equilibrium with the side AB held horizontal?

b)

Draw the free body diagram of a cylinder resting in a channel as shown in the figure. Assume all contact surface to be smooth.
c)   State Lami's theorem?
d)   Differentiate between resolution and composition of forces?
e)   State D' Alembert's principle ? Give example
f)   State the condition under which one can get a zero force member in a truss?
g)   What do you mean by principle of virtual work?
h)   Distinguish between elastic and inelastic collision?
i)   The angular motion of a disc is given by the relation $\theta = 4t^3 - 3t^2 + 2t$. Determine the angular displacement, velocity and acceleration at time t=2sec.
j)   Explain why first moment of area with an axis of symmetry is zero?

Part- II

**Q2**   **Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   **(6 x 8)**

a)
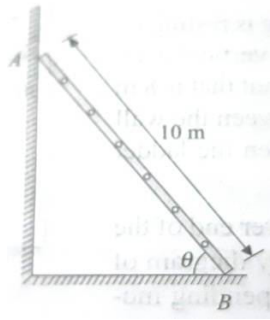
A 10 m long ladder rest on a horizontal floorand leans against a vertical wall. If the coefficient of friction between ladder and floor, and between the ladder and wall are respectively 0.3 and 0.15, determine the angle of inclination of the ladder with the floor at the point of impending motion.

b)   A foot ball is moving at 20m/s hits the ground at an angle of 45^0 to the ground level as shown in the figure. If the coefficient of restitution is 2/3, determine the magnitude and direction of velocity of the ball after impact.
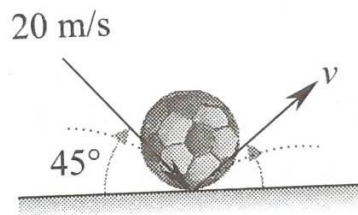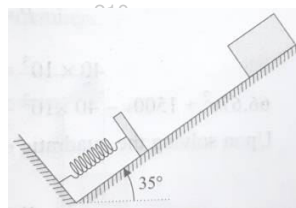

c)
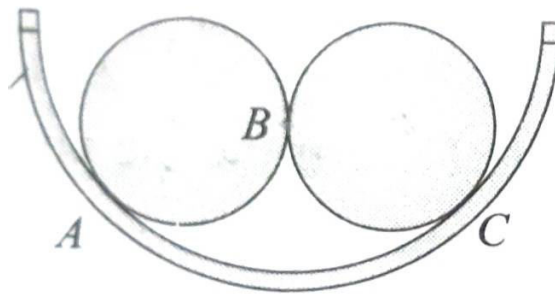
Two smooth spheres each of weight W and diameter 2r rest in ahemispherical shell of diameter 6r as shown in the figure. Determine the contact forces R_A, R_B and R_C

d)


A block of 10kg mass slides down an inclined plane with a slope angle of 35^0. It is stopped by a spring of stiffness 1KN/m. If the block slides down 5m before hitting the spring, then determine the maximum compression of the spring. The coefficient of friction between the block and the inclined plane is o.15.

e) State the Varignon's theorem and prove that it holds for parallel forces?

f) State and prove Pappus-Guldinus theorems.

g)
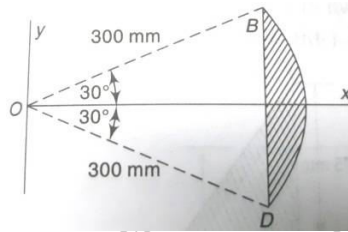
Locate the centroid C of the shaded area of the circular segment BD shown in the figure.

h) A man weighing 667.5N runs and jumps from a pier into a boat with a horizontal velocity v1=3M/s. Assuming that the impact is entirely plastic, find the velocity with which the man and the boat will move away from the pier if the boat weights 890N.

i)
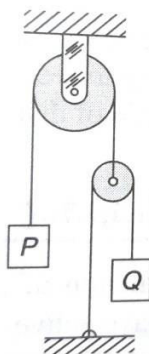
If the system shown in the figure is released from rest in the configuration shown, find the velocity v of the block Q after it falls a distance h=3m. Negelct friction and inertia of the pulleys and assume that P=Q=44.5N.

j) In the guinness world record, a ulled a boeing 747-400 weighing 187 tons, a diastance of 91m in1min 27.7 sec. If the force of friction is 1KN/ton then determine the work done by the man and power exerted by him, if he pulled it at a constant speed.

k) A ball is thrown upwards from the top of a building with an initial velocity of 20m/s and at an angle of 30^0 with the horizontal. The height of the building from the ground level is 25m. Determine (i) where and when it will strike the ground, (ii) velocity with which it strikes the ground (iii) maximum height reached by the ball above the ground level.

l) The motion of a particle in rectilinear motion is defined by the relation $x=t^3-8t^2+16t-5$, where x and t are expressed in meters and seconds respectively. Determine (i) the instants when velocity is zero, (ii) the position and acceleration at those instantsof time, (iii) the instant when the acceration is zero and (iv) the position, displacement, and total diastance travelled when the acceration is zero.

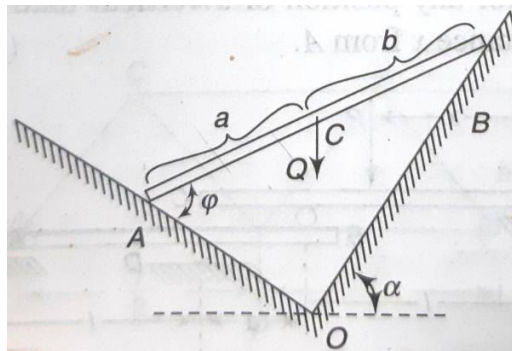**Long Answer Type Questions (Answer Any Two out of Four)**

Q3 (16)
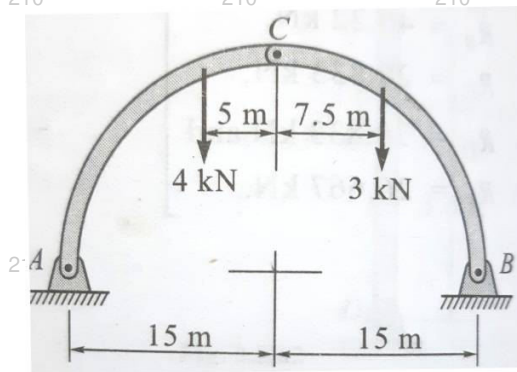
A semicircukar three hinged arc is loaded and suspended as shown in the figure. Find the reactions at the support A and B.
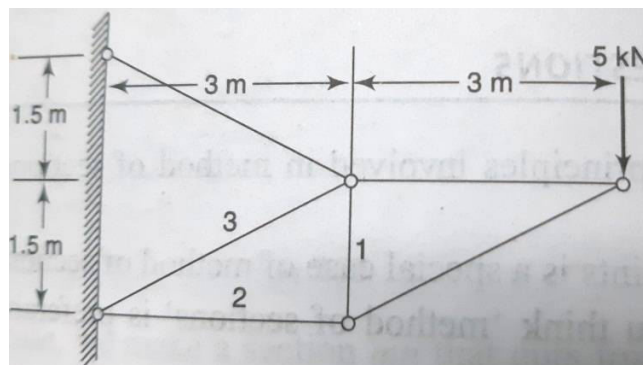
Q4 (16)

A rigid bar AB is supported in a vertical plane by mutually perpendicular smooth surfaces OA and OB, as shown in the figure. Using the principle of virual work, calculate the angle φ defining the configuration of equilibrium of the system.
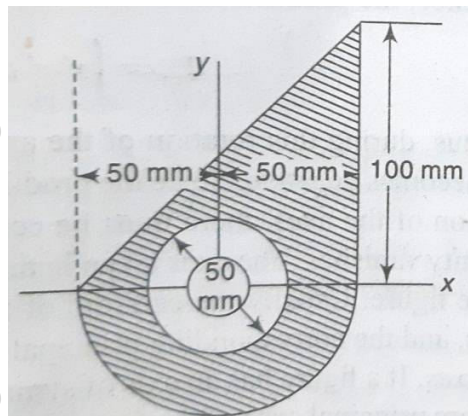
Q5 (16)

Using the method of sections, find the axial force in each of the bars 1,2 and 3 of the plane truss shown in the figure.

Q6 **(16)**

Calculate the moment of inertia of the shaded area shown in figure with respect to the x axis.