Code No: 131AE **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year I Semester Examinations, December - 2017
ENGINEERING MECHANICS
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, ETM, MMT, AE, MIE, PTM, CEE, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a)	State the theorem of varignon.	[2]
b)	Write the equations of equilibrium of a coplanar system of forces.	[3]
c)	Define rolling resistance.	[2]
d)	Define wedge and write the equilibrium conditions for ladder friction.	[3]
e)	Define centroid and centre of gravity of a area.	[2]
f)	Define principal axes and principal moment of inertia.	[3]
g)	Define radius of gyration and polar moment of inertia.	[2]
h)	Differentiate between "Mass moment of inertia" and "Area moment of inertia".	[3]
i)	Differentiate the kinematics and kinetics.	[2]
j)	State work-energy principle for Linear and angular motion of a rigid body.	[3]

PART-B

(50 Marks)

2.a) A 800N Cylinder is supported by the frame ABC, figure 1 which is hinged at A, and rests against wall AD. Determine the reactions at A, B, C and D.

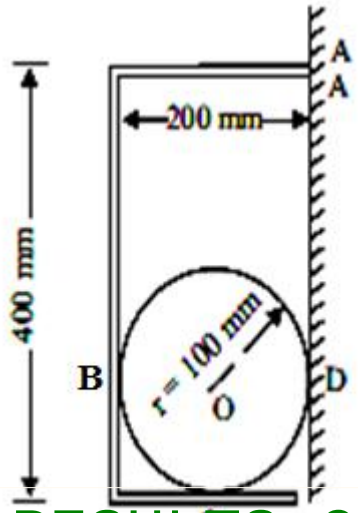

Figure: 1

b) The body shown in figure 2 is acted upon by four forces. Determine the resultant. [5+5]

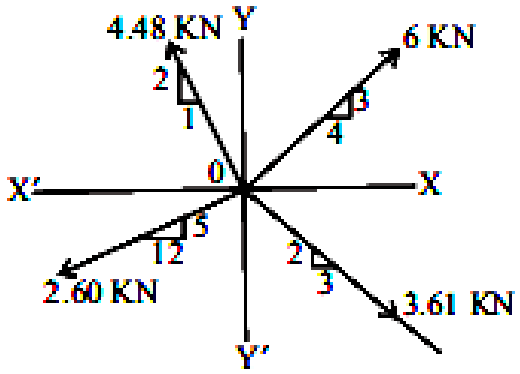

Figure: 2

OR

3.a) Concurrent forces 3P, 7P and 5P act respectively along three directions, which are parallel to the side of an equilateral triangle taken in order. Determine the magnitude and direction of the resultant.

b) What do you understand by resultant of a force system and which are the methods used for determining the resulting of coplanar concurrent force system? Four forces having magnitudes of 20N, 40N, 60N and 80N respectively, are acting along the four sides (1m each), of a square ABCD taken in order, as shown in figure 3. Determine the magnitude and direction of the resultant force. [5+5]

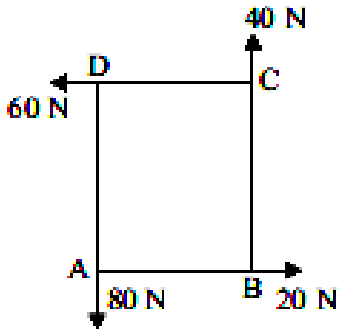

Figure: 3

4.a) What is the characteristics of frictional force? Describe the laws of coulomb friction, explaining the concept of equilibrium of bodies involving dry friction.

b) Two equal bodies A and B of weight 'W' each are placed on a rough inclined plane. The bodies are connected by a light string. If $\mu_A = 1/2$ and $\mu_B = 1/3$, show that the bodies will be both on the point of motion when the plane is inclined at $\tan^{-1}(5/12)$. [5+5]

OR

5.a) Explain the principles of operation of a screw-jack with a neat sketch.

b) A body of weight 100N rests on a rough horizontal surface ($\mu = 0.3$) and is acted upon by a force applied at an angle of 30^0 to the horizontal. What force is required to just cause the body to slide over the surface? [5+5]

6.a) Determine the distance of the center of gravity of a homogeneous truncated right circular cone from the plane of the base if the radius of the base is $\mathbf{r_1}$ the radius of the top $\mathbf{r_2}$ and the altitude of the truncated portion ***h***.

b) Determine the mass moment of inertia of a solid right circular cylinder of uniform density with respect to its centroidal diameter the radius of the cylinder is **R** and its length is **H**. [5+5]

OR

7.a) Derive an expression to determine the moment of inertia of a semi circle about its diametric base.

b) Determine the y coordinate of the centroid of a uniform triangular lamina as shown in Figure 4. [5+5]

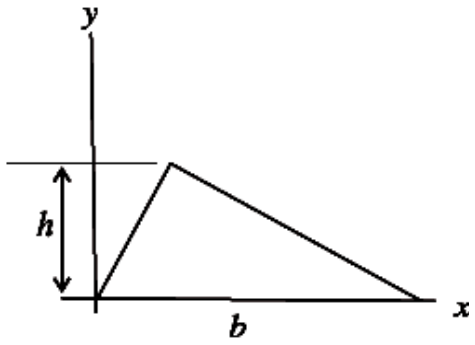

Figure: 4

8. Derive the expression form mass moment of inertia of prism along three axes. [10]

OR

9. Discuss about the expression for finding mass moment of inertia of a cylinder of radius **R** and height **h** about its base. [10]

10.a) A body moves along a straight line and its acceleration 'a' which varies with time 't' is given by a =6-4t. Five seconds after the start of observation, the velocity is 18 m/s. The distance moved by the body 8 sec after the start of observation of motion from origin is 75 m. Determine:

i) The acceleration, velocity and distance from the origin at the start of observation.

ii) The time after the start of observation at which the velocity becomes zero and the distance travelled from the origin.

b) A man weighing 90 kg stands in a boat so that he is 6 m from pier on the shore. He walks 2.4 m in the boat toward the pier and then stops. How far from the pier will he be at the end of this time? The boat weighs 120 kg and there is assumed to be no friction between it and water. [5+5]

OR

11.a) A vehicle accelerates a glider of 125 kg mass from rest to a speed of 50 km/hr. Make calculations for the work done on the glider by the vehicle. What change would occur in the kinetic energy of the glider if subsequently its velocity reduces to 20 km/hr on the application of brakes?

b) A stone is dropped into a well and falls vertically with constant acceleration g =9.81 m/s^2. The sound of impact of the stone on the bottom of the well is heard 6.5 sec after it is dropped. If the velocity of sound is 340 m/s, find the depth of the well. [5+5]

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