Code No: 153AW **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, April/May - 2023
ENGINEERING MECHANICS
(Electrical and Electronics Engineering)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

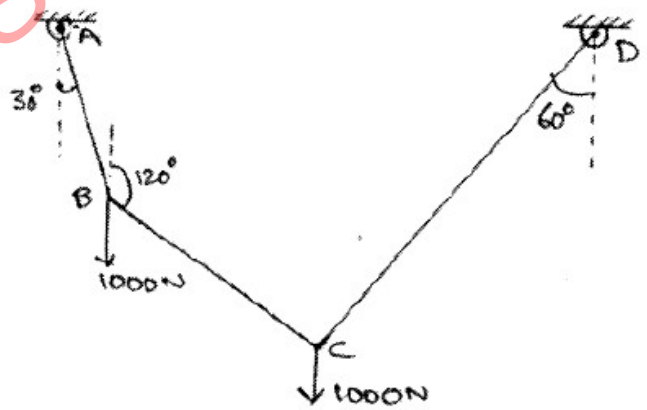
(25 Marks)

1.a)	What is triangle law of force?	[2]
b)	Write the equations of equilibrium of a coplanar system of forces.	[3]
c)	State the laws of dry friction.	[2]
d)	Define angle of friction and angle of repose.	[3]
e)	Define mass moment of inertia of a body about an axis.	[2]
f)	Define radius of gyration and polar moment of inertia.	[3]
g)	What is work-energy principle for rotation bodies?	[2]
h)	Write the impulse-momentum equation and mention its application.	[3]
i)	List out the applications of D'Alembert's principle.	[2]
j)	What is the principle of conservation of energy?	[3]

PART – B

(50 Marks)

2.a) State and prove Lami's theorem
b) A string ABCD attached to fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles as shown in the figure 1. Find the tensions in the portions AB, BC, CD of the string if the inclination of the portion BC with the vertical is 120^0. [3+7]



OR

3.a) Three concurrent forces *P*, *T* and *F* having a resultant of 10 N directed forward and up to the right at $\theta x = 60^0$, $\theta y = 60^0$ and $\theta z = 45^0$. P equal 21 N and passes from the origin through point (3, 2, 6). The value of T is 18 N and is directed from the origin toward point (-6, 6, -3). Determine the magnitude of the third force F and the angles it makes with the reference axes

b) State the necessary and sufficient conditions for equilibrium of rigid bodies in two dimensions. [5+5]

4.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]

OR

5.a) A ladder 5 m long rests on a horizontal ground and leans against a smooth vertical wall at an angle of 700 with the horizontal. The weight of the ladder is 300 N. The ladder is on the verge of sliding when a man weighing 750 N stands on a rung 1.5 m along the ladder. Calculate the coefficient of friction between the ladder and the floor.

b) What should be the value of θ in figure 2 which will make the motion of 900 N block down the plane to impend? The coefficient of friction for all contact surfaces is 0.3. [5+5]

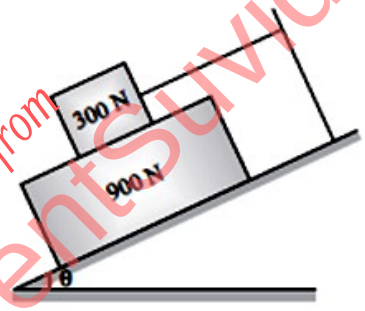


figure 2

6. Derive the mass moment of inertia of a cone about its base having radius r and height h. [10]

OR

7.a) A Cube of side 400 mm has mass density of $2000 kg/m^3$. Find out the mass moment of inertia of the cube about its centroidal axis parallel to one of its sides.

b) A brass cone with base diameter of 400 mm and height of 225 mm is placed on a vertical aluminum cylinder of height 300 mm and diameter 400 mm. Density of brass = $85 kN/m^3$ and density of aluminium = $25.6 kN/m^3$. Determine the mass moment of inertia of the composite body about the vertical geometrical axis. [5+5]

8. A block of 2 kg mass rests on a rough horizontal surface, whose coefficient of kinetic friction is 0.2. It is acted by a horizontal force of 10 N for 5 sec and then it is removed. Determine how far it would travel before coming to rest, assuming the frictional resistance to be uniform. Also, determine the total distance travelled from rest. [10]

OR

9.a) Explain the principle of linear impulse and momentum.

b) Two rigid bodies of weights W_1 and W_2 are connected by an inextensible string and pulled by a force P. The paths of motion of the bodies are at an angle to each other. Derive the work energy equation for the system. [5+5]

10. A body of weight 1 kN is on the horizontal surface of a table. This weight is connected to another body of weight 2 kN by a string passing over a smooth pulley fixed at the corner of the table. The coefficient of friction between 1 kN weight and the table surface is 0.20. If the system is released from rest, find the velocity of 2 kN weight after it has moved 1.2 m using the work-energy method. [10]

OR

11.a) Two bodies A and B are connected by a thread and move along a rough horizontal plane ($\mu = 0.3$) under the action of force of 400 N applied to the body B. Determine the acceleration of the two bodies and tension in the thread using D'Alembert's principle.

b) State work - energy principle. [5+5]

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