NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: III - THEORY EXAMINATION (2023 - 2024)
Subject: Engineering Mechanics

Time: 3 Hours   **Max. Marks: 100**

General Instructions:
IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*
*1. This Question paper comprises of **three Sections -A, B, & C.** It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A   20

1. Attempt all parts:-

1-a.   Which of the following is a vector quantity? (CO1)   1

     (a)   Energy

     (b)   Mass

     (c)   Momentum

     (d)   angle

1-b.   Two non-collinear parallel equal forces acting in opposite direction. (CO1)   1

     (a)   balance each other

     (b)   constitute a moment

     (c)   constitute a couple

     (d)   constitute a moment of couple

1-c.   Who gave the concept of Dry friction? (CO2)   1

     (a)   C.A. Coulomb

     (b)   GA. Coulomb

     (c)   C.P Coulomb

     (d)   Albert Einstein

1-d.   The free body diagram used to explain the theory of dry friction is having _____ distribution of both the normal forces and frictional surface.
(CO2)   1

     (a)   Uneven

(b)   Even

(c)   Uniform

(d)   Equal

1-e.   In determining stresses in frames by methods of sections, the frame is divided into two parts by an imaginary section drawn in such a way as not to cut more than (CO3)   1

    (a)   two members with unknown forces of the frame

    (b)   three members with unknown forces of the frame

    (c)   four members with unknown forces of the frame

    (d)   three members with known forces of the frame

1-f.   Non-coplanar non-concurrent forces are those forces which (CO3)   1

    (a)   Meet at one point, but their lines of action do not lie on the same plane

    (b)   Do not meet at one point and their lines of action do not lie on the same plan

    (c)   Do not meet at one point but their lines of action lie on the same plane

    (d)   None of the above

1-g.   The point through which the whole weight of the body acts is called (CO4)   1

    (a)   Inertial point

    (b)   Center of gravity

    (c)   Centroid

    (d)   Central point

1-h.   The point at which the total area of a plane figure is assumed to be concentrated is called   (CO4)   1

    (a)   Centroid

    (b)   Centre of gravity

    (c)   Central point

    (d)   Inertial point

1-i.   We are given an equation of displacement (s) in terms of time (t). If we differentiate it with respect to t, the equation so obtained will give (CO5)   1

    (a)   velocity

    (b)   acceleration

    (c)   distance traversed

    (d)   None of the above

1-j.   Which of the following statement is wrong ? (CO5)   1

    (a)   A body falling freely under the force of gravity is an exapmle of motion under variable acceleration.

    (b)   A bus going down the valley may have variable acceleration.

    (c)   A lift going down in a gold mine cannot have constant acceleration in the entire journey.

    (d)   In a cricket match, the ball does not move with constant acceleration.

2. Attempt all parts:-

2.a.	What is meant by mechanics? (CO1)	2
2.b.	Define friction.(CO2)	2
2.c.	How the trusses are classified? (CO3)	2
2.d.	What is difference between Centroid and center of gravity? (CO4)	2
2.e.	Define the term instantaneous centre of rotation (CO5)	2

SECTION-B   30

3. Answer any <u>five</u> of the following:-

3-a.	State the conditions for the equilibrium of a two dimensional rigid body (CO1)	6
3-b.	State and Proof of Law of Parallelogram.(CO1)	6
3-c.	Explain Different Types of Lifting Machine.(CO2)	6
3-d.	Define the following : (i) Angle of friction (ii) Co-efficient of friction (CO2)	6
3.e.	The beam AB of span 12 m shown in Fig. is hinged at A and is on rollers at B. Determine the reactions at A and B for the loading shown in the Figure. (CO3)	6
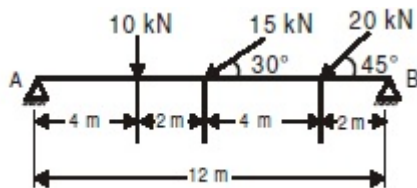
3.f.	Determine the centroid of semicircular Lamina.(CO4)	6
3.g.	Write down the equations of motion under Rectilinear and motion of gravity.(CO5)	6

**SECTION-C**   50
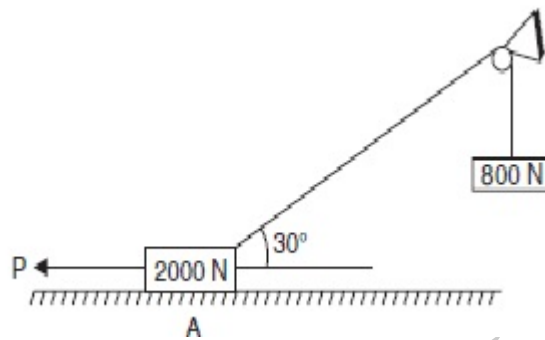
4. Answer any <u>one</u> of the following:-

4-a.	A particle is acted upon by the following forces: (i) A pull of 8 N due North East ; (ii) A pull of 10 N due North; (iii) A pull of 12 N due East; (iv) A pull of 4 N in a direction inclined 60° South of West; (v) A pull of 6 N in a direction inclined 30° East of South. Find graphically the magnitude and direction of the resultant force. (CO1)	10
4-b.	The following forces (all pull) act at a point : (i) 25 N due North ; (ii) 10 N North-East ; (iii) 15 N due East ; (iv) 20 N 30° East of South ; (v) 30 N 60° South of West. Find the resultant force. What angle does it make with East ? (CO1)	10

5. Answer any <u>one</u> of the following:-

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5-a.	What will be the value of P in the system shown in Figure below to cause the motion to impend? Assume the pulley is smooth and the coefficient of friction between the other contact surfaces is 0.2. (CO2)	10
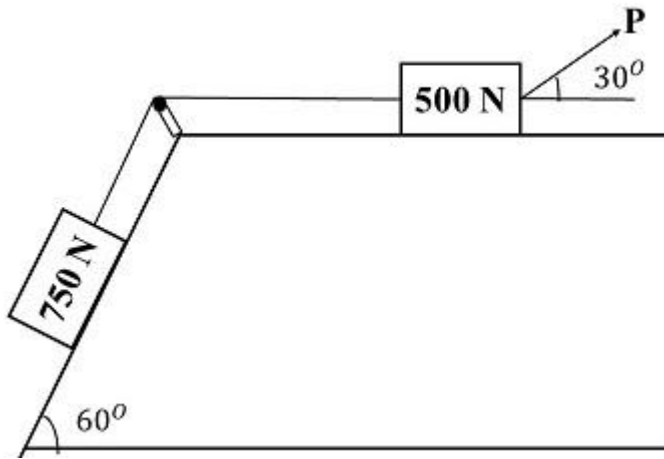
5-b. The block A shown in Fig. below weighs 2000 N. The cord attached to if passes over a frictionless pulley and supports a weight equal to 800 N. The value of coefficient friction between A and the horizontal plane is 0.35. Determine the horizontal force P : (*i*) If the motion is impending towards the left. (*ii*) if the motion is impending towards the right.   (CO2)   10
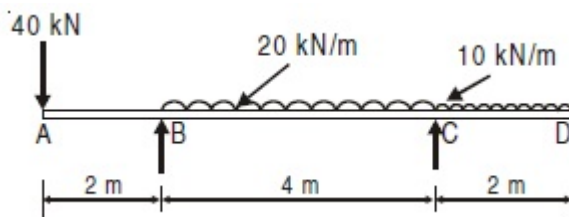

6. Answer any <u>one</u> of the following:-

6-a. Draw the shear force and bending moment diagram of the following: (CO3)   10
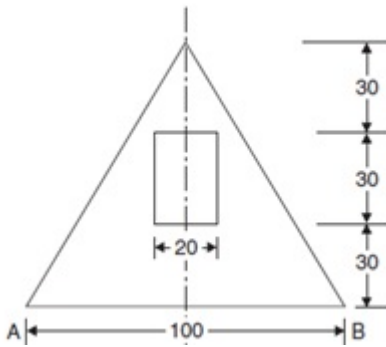

(a) Load Diagram
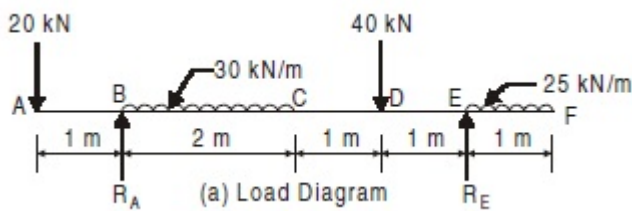
6-b. Draw the shear force and bending moment diagram of the beam loaded and supported as shown in fig.(CO3)   10

7. Answer any <u>one</u> of the following:-

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7-a. Derive the mass moment of inertia of a circular disc. (CO4) 10

7-b. Locate the centroid of the plane area shown in figure and calculate the MOI about centroidal axis. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. A particle is dropped from the top of a tower 100 m high. After one second another particle is projected upwards from the foot of the tower which meets the first particle at a height of 18m. Find the velocity with which the second particle was projected. (CO5) 10

8-b. The motion a particle is given by $a = t^3 - 3t^2 + 5$, where 'a' is the acceleration in m/sec^2 and 't' is time in second. The velocity of the particle at t =1 sec is 6.25 m/sec and the displacement is 8.30 meters. Calculate the displacement and the velocity at t = 2 sec. (CO5) 10