Printed Page:- 06 **Subject Code:- AME0303**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - CARRY OVER THEORY EXAMINATION - AUGUST 2023

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. A force vector with magnitude R and making an angle α with the x-axis is having its component along x-axis and y-axis as: (CO1) 1

(a) R cosine(α) and R sine(α)

(b) R cosine(180-α) and R sine(α)

(c) R cosine(180-α) and R sine(180+α)

(d) R cosine(α) and R sine(180+α)

1-b. Dividing the X-axis component and the Y-axis component of the of the vector making an angle with Y-axis α will give us: (CO1) 1

(a) Cot α

(b) Tan α

(c) Sec α

(d) 1

1-c. For equilibrium the normal forces acts in which direction in the free body diagrams? (CO2) 1

(a) Vertically Upward

(b) Vertically Downward

(c) Horizontally Right

(d) Horizontally Left

1-d. The net torque on the body is zero that means the distance between the force and the rotational axis is zero. (CO2) 1

(a) The first part of the statement is false and other part is true

(b) The first part of the statement is false and other part is false too

(c) The first part of the statement is true and other part is false

(d) The first part of the statement is true and other part is true too

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. For any part of a beam subjected to uniformly distributed load, bending moment diagram is (CO3) 1

(a) Horizontal straight line

(b) Vertical straight line

(c) Line inclined to x-axis

(d) Parabola

1-g. The centre of gravity of a quadrant of a circle lies along its central radius at a distance of (CO4) 1

(a) 0.2 R

(b) 0.3 R

(c) 0.4 R

(d) 0.6 R

1-h. Moment of inertia is the (CO4) 1

(a) Second moment of area

(b) Second moment of mass

(c) Second moment of force

(d) All of these

1-i. If at any given instant, linear velocity and acceleration of a car is known, then 1

mathematically obtain its (CO5)

(a) Angular velocity

(b) Angular acceleration

(c) None of the two

(d) Both of the two

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

(a) The kinetic energy of a body during impact remains constant.

(b) The kinetic energy of a body before impact is equal to the kinetic energy of a body after impact.

(c) The kinetic energy of a body before impact is less than the kinetic energy of a body after impact.

(d) The kinetic energy of a body before impact is more than the kinetic energy of a body after impact.

2. Attempt all parts:-

2.a. Define principle of transmissibility. (CO1) 2

2.b. Define coefficient of static friction. (CO2) 2

2.c. What is the difference between a simply supported truss and a cantilever truss? (CO3) 2

2.d. What is parallel axis theorem and perpendicular axis theorem? (CO4) 2

2.e. Define D'Alembert's principle. (CO5) 2

SECTION B **30**

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

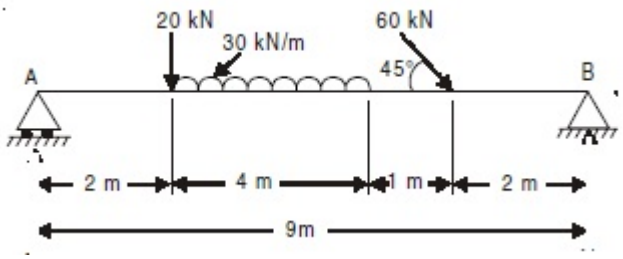
3-a. What are the analytical conditions of equilibrium for a coplanar non concurrent force system in a plane? (CO1) 6

3-b. Find the magnitude and direction of the resultant of two forces 40 N and 60 N acting at a point with an included angle of 40° between them. The force of 60 N being horizontal. (CO1) 6

3-c. Establish relation between efficiency, mechanical advantage and velocity ratio of a machine. (CO2) 6

3-d. Define 'frictional force'. Explain how is friction both desirable and undesirable in engineering applications? (CO2) 6

3.e. Find the reactions at supports A and B of the loaded beam shown in figure. (CO3) 6



3.f. From a rectangular sheet of metal ABCD, in which AB = 40 cm and BC = 60 cm, a triangular piece ABX is removed, such that AX = BX = 25 cm. Calculate the distance of centre of gravity of the remainder. (CO4) 6

3.g. A particle has an initial velocity of 8 m/sec and an acceleration of 3 m/sec^2. Compute its speed after it has moved 60 metre distance. Compute the distance the particle moves during the sixth second. (CO5) 6

SECTION C **50**

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

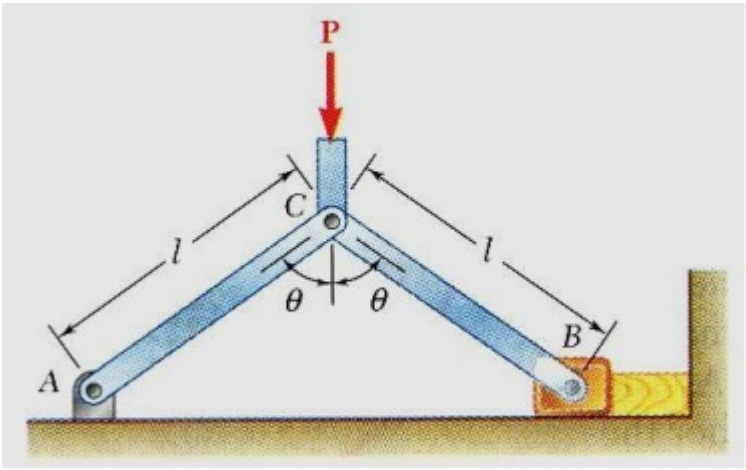
4-a. A particle is acted upon by the following forces: (i) A pull of 8 N due North East ; (ii) A pull of 10 N due North; (iii) A pull of 12 N due East; (iv) A pull of 4 N in a direction inclined 60° South of West; (v) A pull of 6 N in a direction inclined 30° East of South. Find graphically the magnitude and direction of the resultant force. (CO1) 10

4-b. Determine analytically the magnitude and direction of the resultant of the following four forces acting at a point : (i) 10 N pull N 30° E ; (ii) 12.5 N push S 45° W ; (iii) 5 N push N 60° W ; (iv) 15 N push S 60° E. (CO1) 10

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

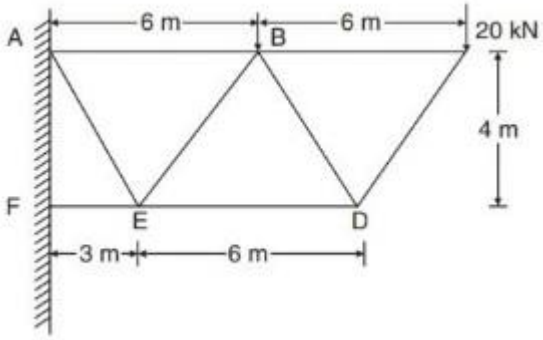
5-a. In a lifting machine, an effort of 500 N is to be moved by a distance of 20 m to raise a load of 10,000 N by a distance of 0.8 m. Determine the velocity ratio, mechanical advantage and efficiency of the machine. Determine also ideal effort, effort lost in friction, ideal load and frictional resistance. (CO2) 10

5-b. Determine the force exerted by the vice on the block as shown in figure below when a given force P is applied at C. Assume that there is no friction. (CO2) 10

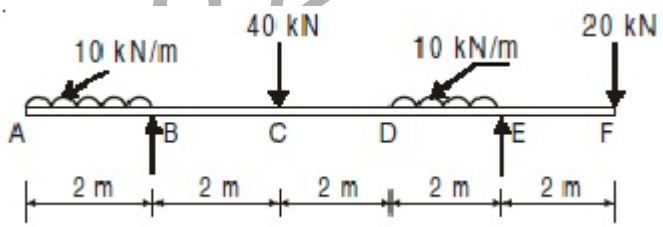


6. Answer any <u>one</u> of the following:-

6-a. Determine the forces in all the members of the trusses shown in figure. Indicate the nature of forces using the convention tension as +ve and compression as –ve. (CO3) 10

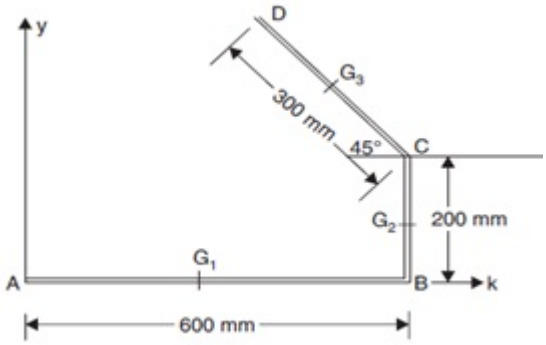


6-b. Draw the shear force and bending moment diagram of the following loaded beams as shown in figure. (CO3) 10

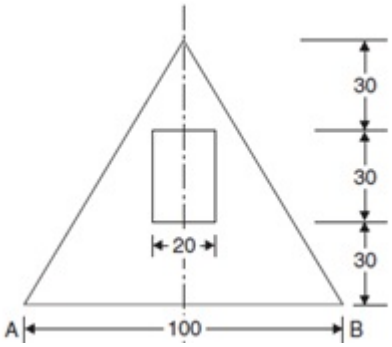


7. Answer any <u>one</u> of the following:-

7-a. Determine the centroid of the wire shown in figure. (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 bullet of weight 50 gm is fired into a body of weight 5 kg, which is suspended by a string 1 m long. Due to this impact, the 5 kg body swings through an angle of 30° from the vertical. Calculate the velocity of the bullet. (CO5) 10

8-b. The speed of a flywheel changes from 10 rad/s to 30 rad/s in 5 seconds time. Determine the angular acceleration of the wheel. How many revolutions the wheel would turn to attain a speed of 600 rev/min? (CO5) 10