Reg. No.																

Question Paper Code	13667

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Third Semester

Civil Engineering

(Common to Mechanical Engineering & Mechanical and Automation Engineering)

20ESCE201 - ENGINEERING MECHANICS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is the SI unit of force? (a) Meter (b) Newton (c) Joule (d) Pascal	1	K1	CO1
2.	The direction of a force in vector notation is often represented by: (a) Angles (b) Scalars (c) Masses (d) Temperatures	1	K1	CO1
3.	What is the term used for the turning effect produced by a force? (a) Momentum (b) Force (c) Moment (d) Pressure	1	K1	CO2
4.	Which term describes the tendency of a body to rotate about an axis? (a) Force (b) Moment (c) Equilibrium (d) Inertia	1	K1	CO2
5.	Outline the type of friction occurs between two stationary objects? (a) Static friction (b) Kinetic friction (c) Rolling friction (d) Sliding friction	1	K2	CO3
6.	Show that the Ladder friction is crucial in ensuring that the ladder does not: (a) Slip (b) Rotate (c) Roll (d) Bend	1	K2	CO3
7.	Which theorem relates to the volume of a solid of revolution? (a) Theorem of Pappus (b) Parallel Axis Theorem (c) Varignon's Theorem (d) Theorem of Moments	1	K1	CO4
8.	Theorem of Pappus is applied for? (a) Calculating centroids (b) Finding moments of inertia (c) Determining surface areas of revolution (d) Analyzing stress in beams	1	K1	CO4
9.	Mass moment of inertia is measured in: (a) $kg \cdot m^2$ (b) m^4 (c) $kg \cdot m$ (d) m^2	1	Kx1	CO5
10.	Impulse is the product of: (a) Force and velocity (b) Force and time (c) Mass and acceleration (d) Mass and velocity	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

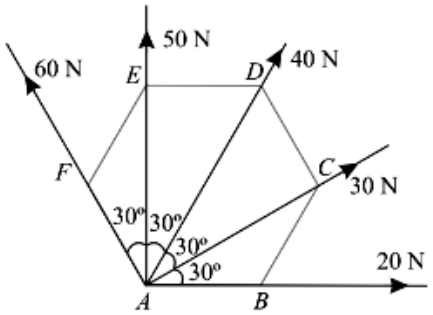
Answer ALL Questions

		Marks	K – Level	CO
11.	Define Lami's theorem.	2	K1	CO1
12.	What is the fundamental vector operations used in force analysis?	2	K1	CO1
13.	How are scalar components of a moment calculated?	2	K1	CO2
14.	What are the types of equilibrium in mechanics?	2	K1	CO2
15.	What happens when two bodies are in contact in terms of friction?	2	K1	CO3
16.	Define rolling resistance.	2	K1	CO3
17.	Explain the centroid of a composite area is not simply the average of its component centroids.	2	K2	CO4
18.	Define the term 'center of mass'.	2	K1	CO4
19.	Define the concept of mass moment of inertia.	2	K1	CO5
20.	When is the product of inertia of an area considered zero?	2	K1	CO5
21.	State Newton's second law of motion.	2	K1	CO6
22.	What is the work-energy principle?	2	K1	CO6

PART - C (6 × 11 = 66 Marks)

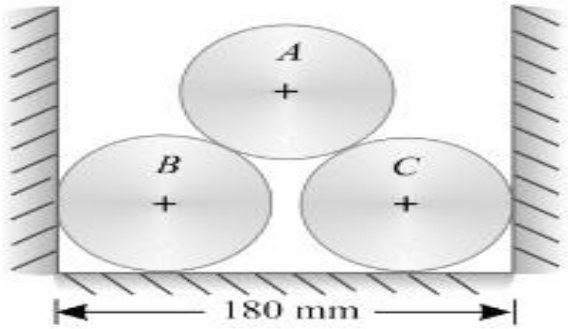
Answer ALL Questions

23. a) The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order. Find the magnitude and direction of the resultant force. *11 K2 CO1*

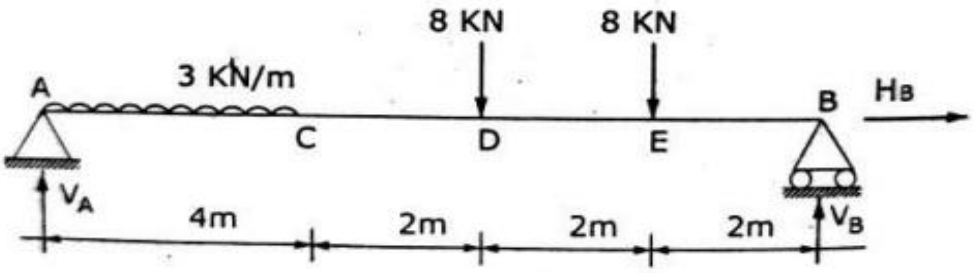


OR

b) Three cylinders weighting 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in Fig. Determine the pressure exerted by (i) the cylinder A on B at the point of contact (ii) the cylinder B on the base and (iii) the cylinder B on the wall. *11 K2 CO1*

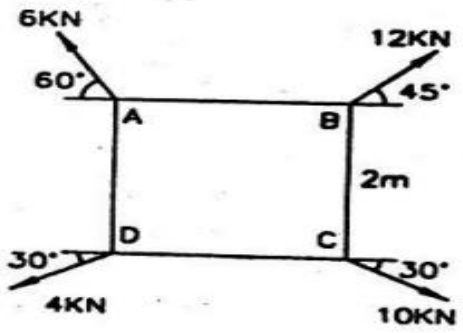


24. a) A beam AB of span 10 m span is loaded as shown in the figure. Determine the reactions at A and B. *11 K2 CO2*

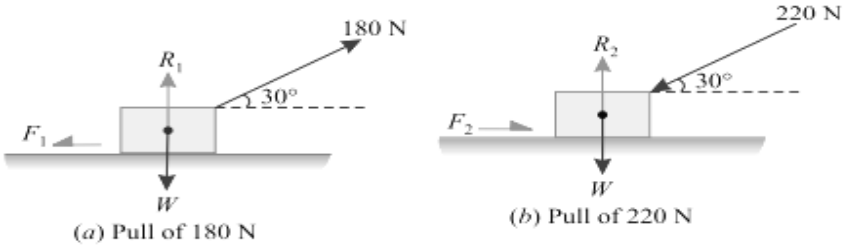


OR

b) Four forces of magnitude and direction acting on a square ABCD of side 2m are shown in the figure. Calculate the resultant in magnitude and direction and locate its point of application with respect to the sides AB and AD. *11 K2 CO2*



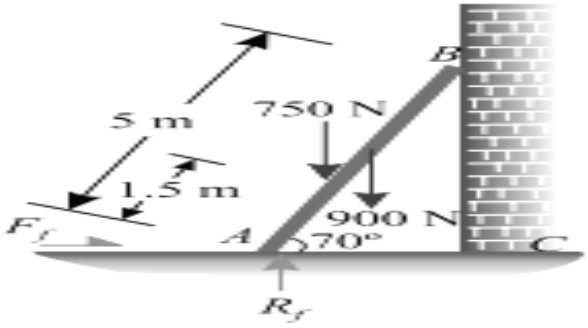
25. a) A body, resting on a rough horizontal plane, required a pull of 180 N inclined at 30° to the plane just to move it. It was found that a push of 220 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. *11 K2 CO3*



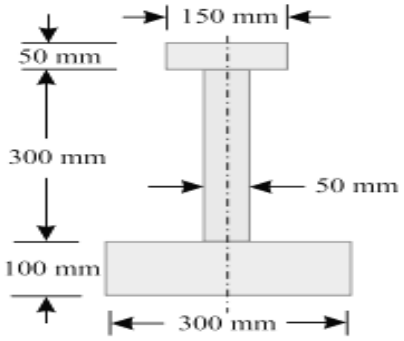
(*a*) Pull of 180 N (*b*) Pull of 220 N

OR

b) A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands on a rung 1.5 metre from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor. *11 K2 CO3*

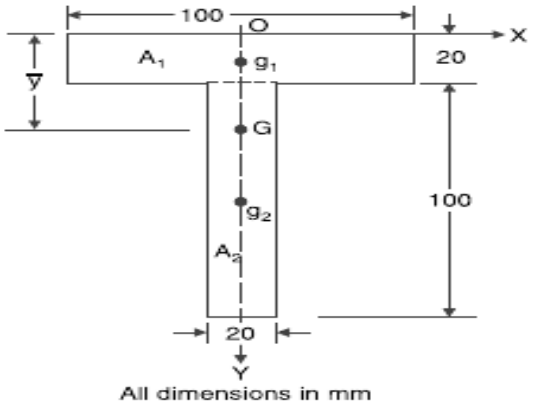


26. a) An I-section has the following dimensions in mm units : Bottom flange = 300 × 100 Top flange = 150 × 50 Web = 300 × 50 Determine mathematically the position of centre of gravity of the section. *11 K2 CO4*

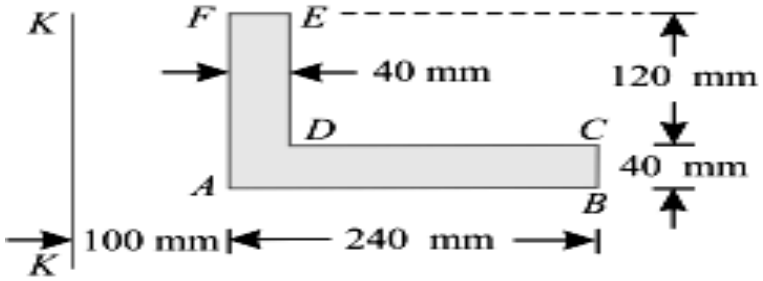


OR

b) Locate the Centre of Gravity of the T-Section shown in the Fig. *11 K2 CO4*

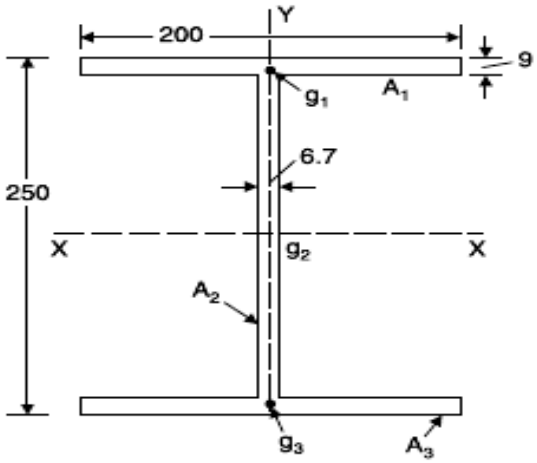


27. a) Figure shows an area ABCDEF Compute the moment of inertia of the above area about axis K-K. *11 K2 CO5*

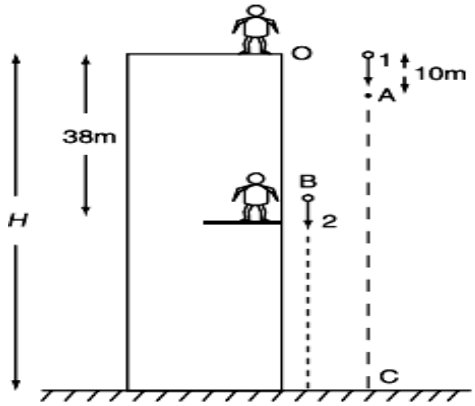


OR

b) Determine the radii of gyration of the symmetric I-section shown in Fig. About its centroidal axes x - x and y - y. *11 K2 CO5*



28. a) Parvathy drops a stone from the top of a tower. When it has fallen at a distance of 10m, Nirmala drops another stone from a point 38 m below the top of the tower. If both the stones reach the ground at the same time as shown in Fig. Calculate (a) height of the tower and (b) the velocity of the stones when they reach the ground. *11 K2 CO6*



OR

b) Two cars are travelling towards each other on a single lane road at the velocities 12 m/sec and 9 m/sec. respectively. When 100 m apart, both drivers realize the situation and apply their brakes. They succeed in stopping simultaneously and just short of colliding. Assume constant deceleration for each case and determine: (a) time required for cars to stop (b) deceleration of each car, and (c) the distance travelled by each car while slowing down. *11 K2 CO6*