Reg. No.															

Question Paper Code	13257

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Second Semester

Civil Engineering

(Common to Third Semester - Mechanical Engineering & Mechanical and Automation Engineering)

20ESCE201 - ENGINEERING MECHANICS

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	One kg force is equal to (a) 8.9 N (b) 9.8 N (c) 0.98 N (d) 7.8 N	*1*	*K1*	*CO1*
2.	The algebraic sum of the resolved parts of a number of forces in a given direction is equal to the resolved part of their resultant in the same direction. This is known as (a) Principle of independence of forces (b) Principle of resolution of forces (c) Principle of transmissibility of forces (d) none of these.	*1*	*K1*	*CO1*
3.	If two forces are perpendicular, then (a) Their dot product is zero (b) Their cross product is zero (c) The angle between the force vector is zero (d) All of these	*1*	*K1*	*CO1*
4.	A couple produces (a) Rotational motion (b) Translatory motion (c) Combined rotational and translatory motion (d) All of these	*1*	*K1*	*CO2*
5.	Varignon's theorem is applicable only when the forces are (a) coplanar (b) concurrent (c) non-concurrent (d) parallel	*1*	*K1*	*CO2*
6.	Moment of a couple is a (a) Free vector (b) fixed vector (c) sliding vector (d) null vector	*1*	*K1*	*CO2*
7.	Coefficient of static friction.....coefficient of dynamic friction (a) equal to (b) less than (c) greater than (d) may be less or greater than	*1*	*K1*	*CO3*
8.	The tangent angle of friction is known as (a) angle of repose (b) cone of friction (c) limiting friction (d) coefficient of friction	*1*	*K1*	*CO3*
9.	A ladder is resting on a rough ground and leaning against a smooth vertical wall. The force of friction will act (a) towards the wall at its upper end (b) upward at its upper end (c) zero at its upper end (d) perpendicular to the wall at its upper end	*1*	*K1*	*CO3*
10.	The point, through which the whole weight of the body acts, irrespective of its position is knows as (a) moment of inertia (b) centre of mass (c) centre of percussion (d) centre of gravity	*1*	*K1*	*CO4*
11.	The unit of moment of inertia of an area is (a) m^4 (b) kg-m^2 (c) kg-m-s^2 (d) kg/m^2	*1*	*K1*	*CO4*
12.	The second moment of area about base of a triangle having width 'b' and height 'h' will be (a) $bh^3/3$ (b) $hb^3/3$ (c) $hb^3/12$ (d) $bh^3/12$	*1*	*K1*	*CO4*
13.	The equation of projectile motion of a particle is a (a) hyperbola (b) rectangular hyperbola (c) spiral (d) parabola	*1*	*K1*	*CO5*
14.	when a car moves at a constant speed around a curved path, its velocity (a) is zero (b) is constant (c) changes in magnitude (d) changes in direction	*1*	*K1*	*CO5*
15.	When a body is lifted up, the work done by force of gravity is (a) positive (b) negative (c) zero (d) none of these	*1*	*K1*	*CO5*
16.	The magnitude of coefficient of restitution for a perfectly elastic impact is (a) imaginary number (b) any negative whole number (c) zero (d) one	*1*	*K1*	*CO5*
17.	Which law of motion states that force equals mass times acceleration? (a) Newton's Ist Law (b) Newton's IInd Law (c) Newton's IIIrd Law (d) D'Alembert's Principle	*1*	*K1*	*CO6*

18. The rate of change of displacement is known as: *1 K1 CO6*
(a) Velocity (b) Acceleration (c) Speed (d) Momentum

19. The Work-Energy Principle states that: *1 K1 CO6*
(a) Work done is equal to the change in kinetic energy
(b) Energy is created from work
(c) Work is independent of energy
(d) Momentum changes when work is done

20. Impulse is the product of: *1 K1 CO6*
(a) Force and velocity (b) Force and time
(c) Mass and acceleration (d) Mass and velocity

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21. Define resultant force. *2 K1 CO1*
22. State the concept of equilibrium of connected bodies. *2 K1 CO1*
23. State the difference between moment and a couple. *2 K2 CO2*
24. State Varignon's theorem. *2 K2 CO2*
25. State Coulomb's law of dry friction. *2 K1 CO3*
26. How can the analysis of wedges be made simple? *2 K2 CO3*
27. Mention the physical significance of first moment of area. *2 K1 CO4*
28. What is principal axis of inertia? *2 K1 CO4*
29. Write down the equations of motion of a body. *2 K1 CO5*
30. Define general plane motion. *2 K1 CO6*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31. a) Determine the resultant of the concurrent force system shown in Fig 1. *10 K2 CO1*

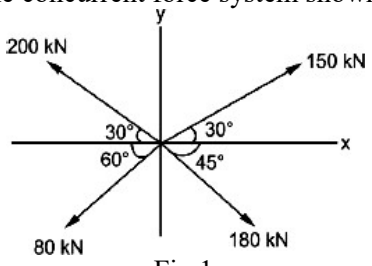

Fig.1

OR

b) 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. *10 K2 CO1*

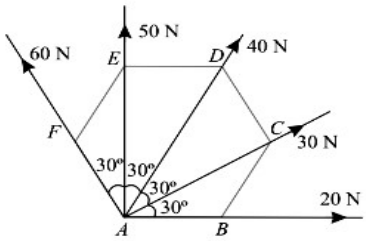

Fig.2

32. a) Find the simplest equivalent force for the system of forces acting on the beam shown in Fig 3. *10 K3 CO2*

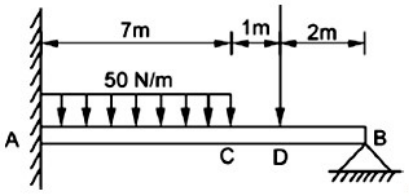

Fig 3

OR

b) A fixed crane has a weight of 3000N and is used to lift a 6000N crate as shown in Fig 4. It is held by a pin at A and a rocker at B. The centre of gravity of the crane is located at G. Determine the reactions at supports A and B. *10 K3 CO2*

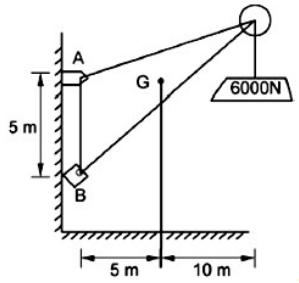

Fig.4

33. a) Block (2) rests on block (1) and is attached by a horizontal rope AB to the wall as shown in fig. What force P is necessary to cause motion of block (1) to impend? The co-efficient of friction between the blocks is 1/4 and between the floor and block (1) is 1/3. Mass of blocks (1) and (2) are 14kg and 9 kg respectively. *10 K3 CO3*

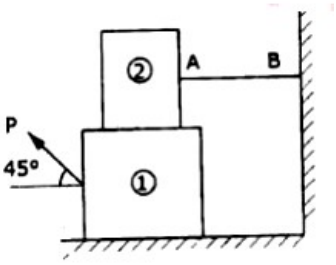

Fig.5

OR

b) A ladder of weight 1000 N and length 4 m rests as shown in Fig 6. If 750 N weight is applied at a distance of 3 m from the top of ladder, it is at the point of sliding. Determine the coefficient of friction between ladder and the floor. *10 K3 CO3*

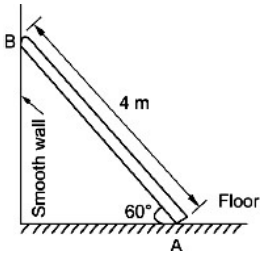

Fig.6

34. a) For the section shown in Fig 7, locate the horizontal and vertical centroidal axes. *10 K2 CO4*

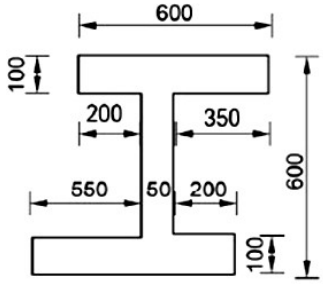

Fig.7

OR

b) A uniform lamina shown in Fig.8 consists of a rectangle, a circle and a triangle. Determine the centre of gravity of the lamina. All dimensions are in mm. *10 K2 CO4*

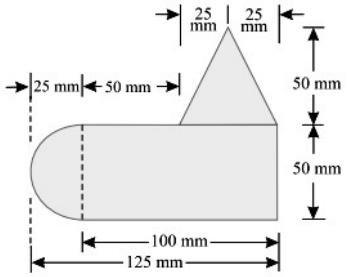

Fig.8

35. a) Find the moment of inertia of a T-section with flange as 150 mm × 50 mm and web as 150 mm × 50 mm about X-X and Y-Y axes through the centre of gravity of the section *10 K2 CO5*

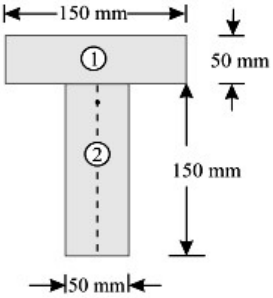

Fig.9

OR

b) Find the moment of inertia about the centroidal X-X and Y-Y axes of the angle section shown in Fig.10 *10 K2 CO5*

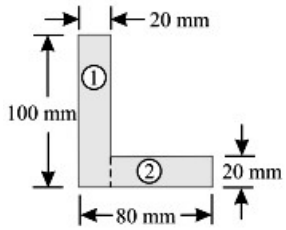

Fig.10

36. a) Two vehicles approach each other in opposite lanes of straight horizontal roadways as shown in Fig 11. At time t = 0 the vehicles have the speeds and positions shown in figure. Find the time and position at which the vehicles meet if both continue to move with constant speed. *10 K3 CO6*

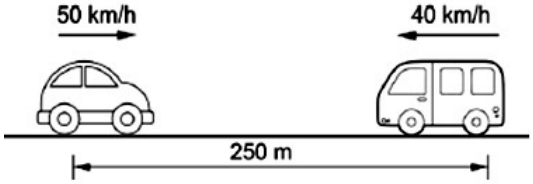

Fig.11

OR

b) Two weights 800 N and 200 N are connected by a thread and they move along a rough horizontal plane under the action of a force of 400 N applied to the 800 N weight as shown in Fig.12 The coefficient of friction between the sliding surface of the weights and the plane is 0.3. Using D' Alembert's principles determine the acceleration of the weight and tension in the thread. *10 K3 CO6*

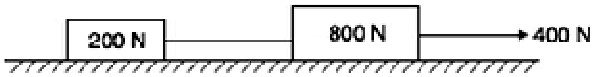

Fig.12