

B.E./B.TECH. Degree Examination, December 2020

Second Semester

ME18201 - Engineering Mechanics

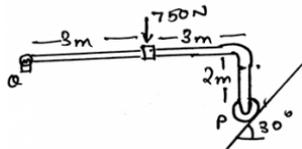
(Regulation 2018)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions**PART A - (8 X 2 = 16 marks)**

1. 1. Which of the following statement is true?
 - a) A scalar is any physical quantity that can be completely specified by its magnitude
 - b) A vector is any positive or negative physical quantity that can be completely specified by its magnitude
 - c) A scalar is any physical quantity that requires both a magnitude and a direction for its complete description
 - d) A scalar is any physical quantity that can be completely specified by its direction
2. The net moment of the body is zero that means the distance between the force and the rotational axis is zero.
 - 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
3. The net moment of the body is zero that means the distance between the force and the rotational axis is zero.
 - 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
4. Determine the horizontal components of the reaction on the beam caused by the roller at P.

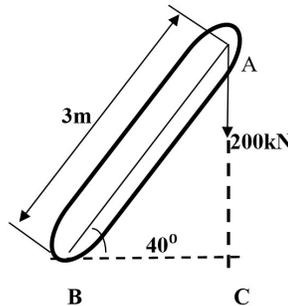


- a) 536N
- b) $536\cos 30^\circ$ N
- c) $536\sin 30^\circ$ N
- d) $536\tan 30^\circ$ N

5. A force of 500N forms angles 60° , 45° and 120° respectively with x y and z axes. Write the force in vector form.
6. Three couples +16Nm, -45Nm and +120Nm are acting in the xy, yz and xz planes. Determine the magnitude of the resultant vector of these couples.
7. A ball is dropped from a height of 10m on a fixed plane. Determine the height to which the ball rebounds after first second and third rebounded. Take $e=0.8$
8. A fly wheel 1.2m in diameter accelerates uniformly from rest to 700rpm in 10 sec. calculate its angular acceleration.

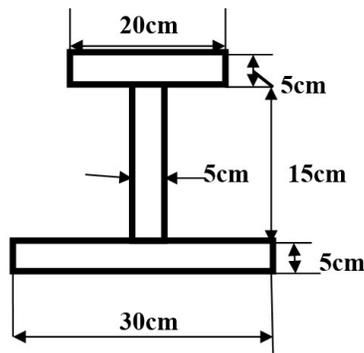
PART B - (4 X16 = 64 marks)

9. (a) A 200kN vertical force is applied to the end of a lever which is attached to a shaft at 'B' (16) as shown in figure below. determine the following
 - i.) The magnitude of horizontal force applied at A which creates same moment about B.
 - ii) The smallest force applied at a which creates the same moment about B.
 - iii) How far from the end B, a 400kN vertical force must act to create the same moment about B.
 - iv) Replace the given system of force at B.

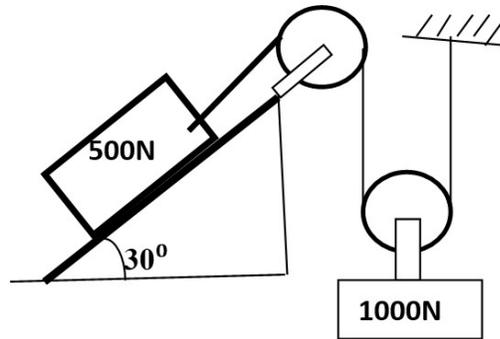


(OR)

- (b) Determine the centroid of the cross sectional area of an unequal I- section shown below. (16)



10. (a) Two blocks of weights 500N and 1000 N are shown in figure below. The coefficient of friction between the 500N block and the inclined plane is 0.3. Determine the acceleration of each block and the distance travelled by 500N in 4 seconds. (16)



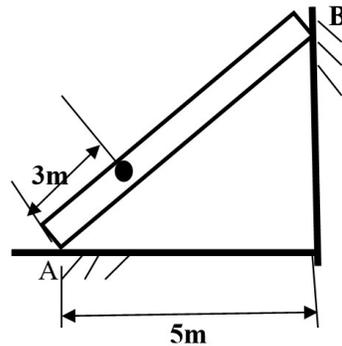
(OR)

- (b) A body moves along a straight line and its acceleration varies with time is given by $a = 2 - 3t$. After 5 seconds from start of observations its velocity is observed to be 20m/sec. After 10 seconds from start of observations the body was at 85 m from the origin. (16)
- Determine its acceleration, velocity and distance from the origin at the start of observations.
 - Determine the time after start of observations in which the velocity becomes zero and its distance from the origin.
11. (a) Two balls of mass 2kg and 4 kg are moving in the same direction with the velocities of 6m/sec and 1.5 m/sec respectively inclined at 45° and 60° with the line of centre. If the co-efficient of restitution is 0.6, determine their velocities in magnitude and the direction after impact (16)

(OR)

- (b) (i) An automobile is decelerating from a speed of 65 km/hr at the rate of 1.5m/sec^2 . How long will it take to come to rest and how far will it have gone? (6)
- (ii) A projectile is thrown with a velocity of 5 m/sec at an elevation of 60° to the horizontal. Determine the velocity of another projectile thrown at an elevation of 45° which will have (10)
- Equal horizontal range
 - Equal maximum height
 - Equal time of flight

12. (a) A ladder is 8 m long weighs 300N. The centre of gravity of the ladder is 3m along the length of ladder from the bottom end. The ladder rests against a vertical wall at B and on the horizontal floor at A as shown in the figure below. Determine the safe height to which a man weighing 900N can climb without making the ladder slip. The co-efficient of friction between ladder and floor is 0.4 and the ladder top and wall is 0.3. (16)



(OR)

- (b) The co-efficient of static and kinetic friction between the 100kg block and inclined plane are 0.3 and 0.2 respectively. Determine, (16)
- The friction force 'F' acting on the block when P is applied with the magnitude of 200 N to the block at rest.
 - The force P required to initiate motion up the incline from rest and
 - The friction force F acting on the block, if $P=600\text{N}$.

