G.R. No.

Paper code - U 239 - 153 (ESE)

DECEMBER- 2019/ ENDSEM
S. Y. B.TECH. (Mechanical Engineering) (SEMESTER (II))
COURSE NAME: ENGINEERING MECHANICS
COURSE CODE: MEUA21183

(PATTERN 2018)

Time: [2 Hours]

[Max. Marks: 50]

(*) Instructions to candidates:
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of scientific calculator is allowed.
4) Assume suitable data where ever required.

Q.1)   Attempt any **one**

a) The resultant of two forces, one of which is double the other is 260 N. If the direction of larger is reversed and the other remains unaltered, the resultant reduces to 180 N. Determine the magnitude of the forces and the angle between the forces.   [4]

b) State the Varignon's theorem and derive the equation to find moment of resultant of number of forces.   [4]

Q.2)   Attempt any **one**

a) The screw jack carries a load of 10 kN. It has a square threaded screw of pitch 25 mm and mean diameter 60 mm. The coefficient of friction between screw and the nut is 0.20. Calculate the torque required to raise the load and the force required at the end of the handle 500 mm long to lower the load.   [4]

b) A weight 500 N starts moving up on rough inclined plane supported by a force of 300 N parallel to the plane. Find the inclination of the plane with horizontal and the coefficient of friction between the inclined plane and the weight.   [4]

Q.3)   Attempt any **one**

a) Determine the polar moment of inertia of the I-section shown in **Figure 1**. Also determine radii of gyration with respect to x-x axis and y-y axis.   [6]
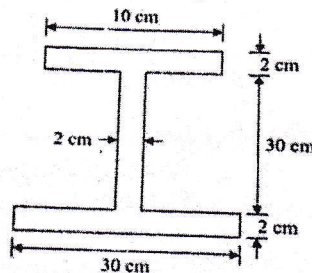

Figure 1

b) Define mass moment of inertia and derive equation for mass moment of inertia of circular plate about their centroidal axis.   [6]

Q.4) Attempt any **one**

a) A particle under a constant deceleration is moving in a straight line and covers a distance of 20 m in first 2 seconds and 40 m in the next 5 seconds. Calculate the distance covers in the subsequent 3 seconds and the total distance covered before it comes to rest. [6+4]

Explain types of motion of a rigid body.

b) Determine the tensions in the strings and acceleration of blocks A and B weighing 1500 N and 500 N connected by an inextensible string as shown **Figure 2**. Assume pulleys as frictionless and weightless. [6+4]
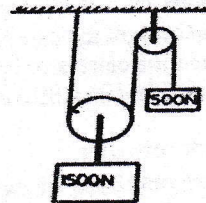

Figure 2

A mine cage weighs 12 kN and carrying a maximum load of 20 kN. The average frictional resistance of the slide guys is 500N. What constants cable tension is required to give a loaded cage an upward velocity of 3 m/sec, from the rest in a distance of 3m?

Q.5) Attempt any **one**

a) Define curvilinear motion with suitable examples. A shaper quick return mechanism shown in **Figure 3** rotates at a constant angular speed of 60 r.p.m in the counterclockwise direction. Determine the angular acceleration of the connecting rod BA (i) When the connecting rod BA makes maximum oblique angle and (ii) When the crank OA is horizontal. [13]
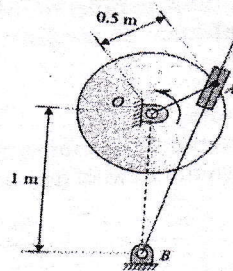

Figure 3

b) Explain following in brief [6+7]
   (i)   Rectangular components of acceleration
   (ii) Tangential and normal component of acceleration

A motorist enters a curved path with a 90 m radius of curvature with a velocity of 90 kmph and reduces the speed uniformly to 60 kmph in 10 seconds. Determine the total acceleration magnitude and it's direction at the end of 5 seconds.

Q.6)   Attempt any **one**

a) A flywheel weighing 50 kN and having radius of gyration 1m loses its   [6+7]
    speed from 400 rpm to 280 rpm in 2 minutes. Calculate
    (i) The retarding torque acting on it.
    (ii) Change in its kinetic energy during the above period
    (iii) Change in its angular momentum during the same period.

    Explain concept of instantaneous center of rotation.
    A link AB is moving in a vertical plane. At a certain instant, when the link
    is inclined at 60° to the horizontal, the point A is moving horizontally at 2
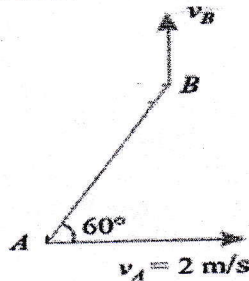   m/s, while B is moving in a vertical direction. Find the velocity of B.

Figure 4

b) The pulley B shown in **Figure 5** is rotating at the rate of 5 rad/sec²,   [13]
    clockwise. If the deceleration to be 1.2 rad/sec², how much distance
    blocks C and D move before coming to rest? How many revolutions are
    made by pulleys A and B during this period? Assume no slip between the
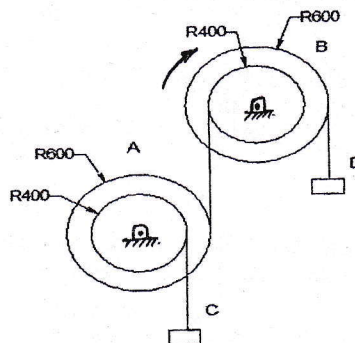   wire and pulley. All dimensions are in mm.

Figure 5

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