Hall Ticket No | | | | | | | | | | | Question Paper Code: AME002

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech II Semester End Examinations (Supplementary) - May, 2019

Regulation: IARE – R16

ENGINEERING MECHANICS

Time: 3 Hours **(Common to AE | ME | CE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Define angular displacement, angular velocity and angular acceleration. Write governing equations of velocity and acceleration of rigid body motion. **[7M]**

   (b) A car of mass 1500kg is uniformly accelerated, its speed increases from 50kmph to 75kmph after travelling a distance of 200m. The resistance to the motion of the car is 0.2% of the weight of the car. Determine (i) the maximum power required, (ii) the power required to maintain a constant speed of 75km/hr. **[7M]**

2. (a) Define instantaneous centre of rotation (ICR). Write kinematic equations of linear motion with constant acceleration. **[7M]**

   (b) A ship being launched slips down the skids with uniform acceleration. If 10s is required to traverse the first 4.8m, what time will be required to slide the total distance of 120m? With what velocity v will the ship strike the water? **[7M]**

UNIT – II

3. (a) Define the terms kinetics and particle. Distinguish between mass and weight. **[7M]**

   (b) A small block of weight W rests on an adjustable inclined plane as shown in Figure 1. Friction is such that sliding of the block impends when $\alpha = 30°$. What acceleration will the block have when $\alpha = 45^0$? Neglect any difference between static and kinetic friction.

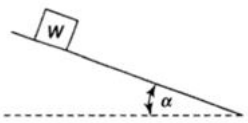

Figure 1

4. (a) State the effect of translation motion on rigid bodies and rotational motion on rigid bodies. **[7M]**

   (b) Weights W and 2W are supported in a vertical plane by a string and pulleys arranged as shown in Figure 2. Find the magnitude of an additional weight Q applied on the left which will give a downward acceleration a = 0.1g to the weight W. Neglect friction and inertia of pulleys. **[7M]**

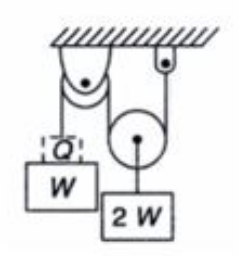

Figure 2

UNIT – III

5. (a) Write a short note on central and non central impacts and their types. **[7M]**

   (b) The 75-kg boy leaps off cart A with a horizontal velocity of v' = 3 m/s measured relative to the cart as shown in Figure 3. Determine the velocity of cart A just after the jump. If he then lands on cart B with the same velocity that he left cart A, determine the velocity of cart B just after he lands on it. Carts A and B have the same mass of 50 kg and are originally at rest. **[7M]**

Figure 3

6. (a) State the principle of conservation of linear momentum of a particle. Differentiate between work done and virtual work done. **[7M]**

   (b) A gun of mass 30 tonnes fires a 456Kg projectile with a velocity of 305 m/s. With what initial velocity will the gun recoil? If the recoil is overcome by an average force of 600KN, how far will the gun travel? How long will it take? **[7M]**

UNIT – IV

7. (a) State Work –energy principle. Write the expression for kinetic energy of a body rotating about a fixed axis. **[7M]**

   (b) The 2-KN car has a velocity of v_1 = 100 km/h when the driver sees an obstacle in front of the car as shown in Figure 4. It takes 0.75 s for him to react and lock the brakes, causing the car to skid. If the car stops when it has traveled a distance of 175 m, determine the coefficient of kinetic friction between the tires and the road. **[7M]**

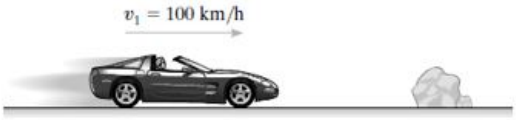

Figure 4

8. (a) List the different forms of mechanical energy? State salient features of conservative force? **[7M]**

   (b) The spring is unstretched when s = 1m and the 15-kg block is released from rest at this position as shown in Figure 5. Determine the speed of the block when s = 3m. The spring remains horizontal during the motion, and the contact surfaces between the block and the inclined plane are smooth. **[7M]**

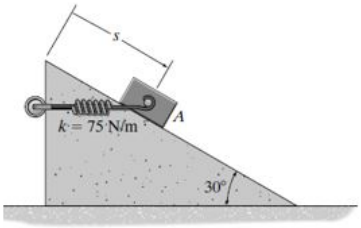

Figure 5

UNIT – V

9. (a) Define the terms periodic time and frequency and give their units. Write the equation of simple harmonic motion with notations. **[7M]**

   (b) A compound pendulum consists of a uniform rod of length 0.5 m weighing 40 N and another uniform rod of 0.4 m width weighing 32 N welded together as shown in Figure 6. Determine its period of vibration. **[7M]**

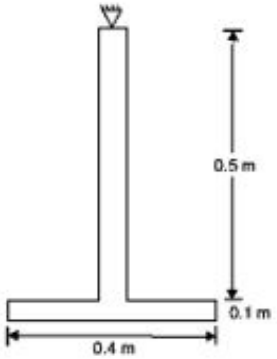

Figure 6

10. (a) Discuss the different types of vibrations? Write the expression for time period of a simple pendulum. **[7M]**

(b) A particle has simple harmonic motion. Its maximum velocity was 6 m/sec and the maximum acceleration was found to be 12 m/sec^2. Determine its angular velocity, amplitude. Also determine its velocity and acceleration when displacement is half the amplitude **[7M]**

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