

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES FAST

National University of Computer & Emerging Sciences, Karachi

Fall-2021 CS-Department

Mid Term I

26th November, 2020, (10:00 am – 12:00pm)



Course Code: EE (117)	Course Name: Applied Physics
Instructor Name / Names: Mr. Adeel , Mr. Javaid Qureshi , Mr. Junaid Rabbani , Mr. Muhammad Ahsan, Ms. Quratulain, Ms. Rabia Tabassum , Mr. Waqar Ahmed	
Student Roll No:	Section :

Instructions:

- Return the question paper with your answer sheet.
- Read each question completely before answering it. There are **3 questions and 2 pages**.
- All the answers must be solved according to the sequence given in the question paper.

Time: 120 minutes.

Max Marks: 75 points

Question: 1(Vectors)[25]

Q1a : Consider the two vectors $\mathbf{A} = 3\mathbf{i} - 2\mathbf{j}$ and $\mathbf{B} = -\mathbf{i} - 4\mathbf{j}$. Calculate (a) $\mathbf{A} + \mathbf{B}$, (b) $\mathbf{A} - \mathbf{B}$, (c) $|\mathbf{A} + \mathbf{B}|$, (d) $|\mathbf{A} - \mathbf{B}|$ and (e) the directions of $\mathbf{A} + \mathbf{B}$ and $\mathbf{A} - \mathbf{B}$. [6]

Q.1b: Here are three vectors in meters: $\mathbf{d}_1 = -3\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$, $\mathbf{d}_2 = -2\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}$, and $\mathbf{d}_3 = 2\mathbf{i} + 3\mathbf{j} - 1\mathbf{k}$. What result from (a) $\mathbf{d}_1 \times (\mathbf{d}_2 + \mathbf{d}_3)$ and (b) $\mathbf{d}_1 \cdot (\mathbf{d}_2 \times \mathbf{d}_3)$ [4]

Q1c: The two vectors shown in Fig-1 lie in an xy plane. What are the signs of the x and y components, respectively, of (i) $\mathbf{A}_1 + \mathbf{A}_2$ (ii) $\mathbf{A}_1 - \mathbf{A}_2$, and (iii) $\mathbf{A}_2 - \mathbf{A}_1$? [3]

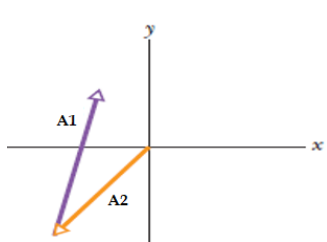


Fig-1

Q1d: Find the angle between the vector $\mathbf{A} = 3\mathbf{i} - 4\mathbf{j} - 7\mathbf{k}$ and the x, y, and z axes, respectively. [6]

Q1e: Determine the value of "a" so that $\mathbf{A} = 2\mathbf{i} + a\mathbf{j} + \mathbf{k}$ and $\mathbf{B} = 4\mathbf{i} - 2\mathbf{j} - 2\mathbf{k}$ are perpendicular. [6]

Question: 2(Motion)[25]

Q2a: The position of a particle moving in an XY direction is given by

$$\mathbf{r} = [2t^3 - 7t^2] \mathbf{i} + [5 - 5t^4] \mathbf{j}, \text{ where "x" is in meters and "t" is in seconds.}$$

(i) Find an expression for the velocity and acceleration as a function of time.

(ii) At $t = 2.00$ s, what is the magnitude of the velocity and acceleration?

(iii) Find the angle of velocity vector at $t = 2.00$ s relative to the positive direction of the x axis? [6]

Q2b: A car travels on a straight road for 30 km at 40 km/h. It then continues in the same direction for another 30 km at 70 km/h. (a) What is the average velocity of the car during the full 60 km trip? (Assume that it moves in the positive x direction.) (b) What is the average speed? (c) Graph x versus t and indicate how the average velocity is found on the graph. [6]

Q2c:(i) Which velocity component retains its initial value throughout the flight. (in projectile motion) and why? (ii) At what point in the path of a projectile is the speed a minimum? Show this point by drawing a projectile path. [3]

Q2d: Only draw the graphs of velocity, acceleration and position of a car that starts at rest, accelerates for an interval, then moves with constant velocity, and then brakes with negative acceleration to rest again. [4]

Q2e: Discuss the circumstances when velocity and acceleration are perpendicular to each other. Give relevant two examples. [2]

Q2f: Find the angle of the projectile if the maximum height and range of the projectile are equal. [4]

Question: 3(Force and Newton's Laws)[25]

Q3a: A ball of mass $m_1 = 15\text{kg}$ and a block of mass $m_2 = 23\text{kg}$ are attached by a lightweight cord that passes over a frictionless pulley of negligible mass, as shown in Fig-2. The block lies on a frictionless incline of angle ($\theta = 48^\circ$). Find the magnitude of the acceleration of the two objects and the tension in the cord. [6]

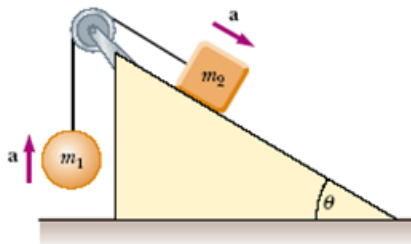


Fig-2

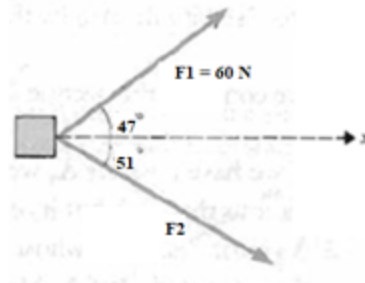


Fig-3

Q3b: A box is pulled by two persons exerting the forces F_1 and F_2 shown in Fig-3, where F_1 is given as 60N . (a) What force F_2 must be applied so that the box moves only in the x direction? (b)What single force could replace F_1 and F_2 so that the box moves only in the x direction? [6]

Q3c: A baseball player with mass 79kg, sliding into a base is slowed by a force of friction of 470N. What is the coefficient of kinetic friction between the player and the ground? [2]

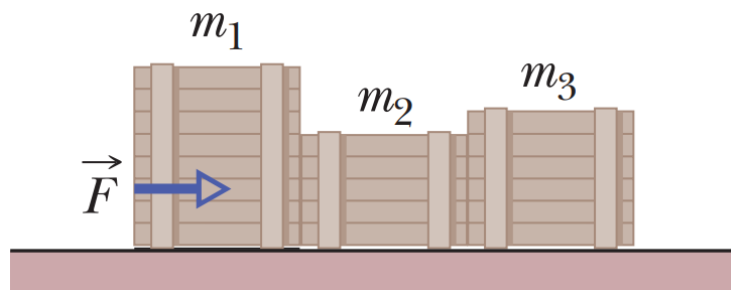
Q3d: Explain, why the coefficient of static friction is always greater than the coefficient of kinetic friction for a given pair of surfaces? [2]

Q3e: A light object and a heavy object have the same momentum. Which has the greater kinetic energy? [2]

Q3f: Consider two bodies of different mass moves towards the Earth surface by neglecting air friction. Which body reached the Earth's surface earlier than the other one? Give an explanation.

Q3g: You have most likely had the experience of standing in an elevator that accelerates upward as it moves toward a higher floor. In this case, you feel heavier. Are you heavier, or has something apparently increased? Explain your answer. Also define the term "Weightlessness". [5]

Q3h: When a bus stops suddenly, the passengers tend to move forward relative to their seats. Why? Give Reason(s). The [2]



figure



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