NS-1001: Applied Physics (SE, AI, DS)

Serial No:

Sessional Exam-I
Total Time: 1 Hour
Total Marks: 40

Saturday, 23rd September, 2023

Course Instructors

Signature of Invigilator

Mrs. Aisha Ijaz, Dr.Tashfeen, Mr.Junaid Khan

Student Name	Roll No.	Course Section	Student Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Use the back of the last page for rough work.
3. If you need more space, write on the back side of the paper and clearly mark question and part number etc.
4. After asked to commence the exam, please verify that you have **Six (06)** different printed pages including this title page. There are total of **3** questions.
5. Calculator sharing is strictly prohibited.
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

	Q-1	Q-2	Q-3	Total
Marks Obtained				
Total Marks	20	10	10	40

Question 1 [5+7+8]

(i). Determine the directional derivatives $D_u f$ for $f(x,y,z) = x^2y^3 - 4xz$ in the direction of $v = -\hat{i} + 2\hat{j} + 0\hat{k}$

(ii). A weather balloon is floating at a constant height above earth when it releases a pack of instruments. If the pack hits the ground with a downward velocity of -73.5m/s. How far did the pack fall?

(iii). Compute the divergence and curl of the given function.

$$\vec{F} = \left(4y^2 + \frac{3x^2y}{z^2}\right)\vec{i} + \left(8xy + \frac{x^3}{z^2}\right)\vec{j} + \left(11 - \frac{2x^3y}{z^3}\right)\vec{k}$$

Question 2[10]

You are to throw a ball with a speed of 12.0 m/s at a target that is height h = 5.00 m above the level at which you release the ball as shown in the figure below. You want the ball's velocity to be horizontal at the instant it reaches the target. (a) At what angle θ above the horizontal must you throw the ball? (b) What is the horizontal distance from the release point to the target? (c) What is the speed of the ball just as it reaches the target?
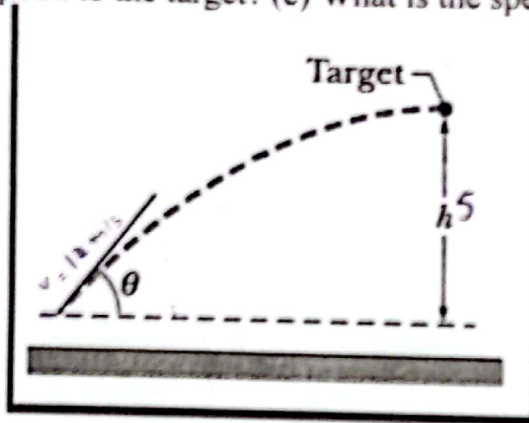
Question 3[10]

The speed of a bullet as it travels down the barrel of a rifle toward the opening is given by $v = (-5.00 * 10^7)t^2 + (3.00 * 10^5)t$ where v is in meters per second and t is in seconds. The acceleration of the bullet just as it leaves the barrel is zero. (a) Determine the acceleration and position of the bullet as functions of time when the bullet is in the barrel. (b) Determine the time interval over which the bullet is accelerated. (c) Find the speed at which the bullet leaves the barrel. (d) What is the length of the barrel?

Formula Sheet

$$R = \frac{v_0^2 \sin 2\theta}{g}$$

$$t = \frac{2v_0 \sin \theta}{g}$$

$$y = (\tan \theta)x - \frac{g}{2v_0^2 \cos^2 \theta} x^2$$

$$H = \frac{v_0^2 \sin^2 \theta}{2g}$$

...................................The End.........................

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