FAST- National University of Computer & Emerging Sciences, Karachi.
Department of Computer Science,
Final Examinations, Spring 2020
06th July 2020, 9:00 am – 12:30 pm

Course Code: EE 117	**Course Name:** Applied Physics
Instructor Names: Javaid Iqbal Qureshi	
Student Roll No:	**Section No: BCS (2A)**

Instructions:

- Read each question completely before answering it. There are 16 questions on 5 pages
- The Exam will start on: 9:00 am; and will End at: 12:30 pm, including the submission time
- You will attempt this paper offline, in your hand writing, however, for some questions, you may use your PC
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper
- All the answers must be solved according to the SEQUENCE given in the question paper.
- Show all steps clearly
- You may use cam-scanner, MS lens or any equivalent application to scan and convert your hand-written answer sheets + any screenshot in a single PDF file
- The paper should be submitted using our Google classroom **Applied Physics** Spring 2020 having **Code:** . For this purpose, you are given 30 minutes, already mentioned in the above instructions. Additionally, after submitting over there, you should also submit it over the slate (if possible), otherwise email exactly the same copy to your instructor.
- Put your **signature on every page** along with **YOUR Roll No/ID, and page number**.
- Please fill the below table with your details. A sample value for a student having Roll number: K16-2345 is provided.

Description	Sample Value	Value for your Roll Number
The last 4 digits of your Roll Number	RollNo: 2345 a[0] = 2, a[1] = 3 a[2] = 4, a[3] = 5	
a[0]a[1] means first two digits of your Roll No, i.e., 23 a[2]a[3] means last two digits of your Roll No, i.e., 45 88 x (a[0] / 9) means 88 multiply by (2/9) i.e., 88 x 2/9 = 19.55		

Time Allowed: 180 + 30 min **Maximum Points**: 100 Points

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Q.1. Fig: 1 shows the velocity of a particle moving on an x - axis. What are: [5]

(a) the initial and (b) the final directions of movement?
(c) Does the particle stop momentarily?
(d) Is the acceleration positive or negative?
(e) Is it constant or varying?

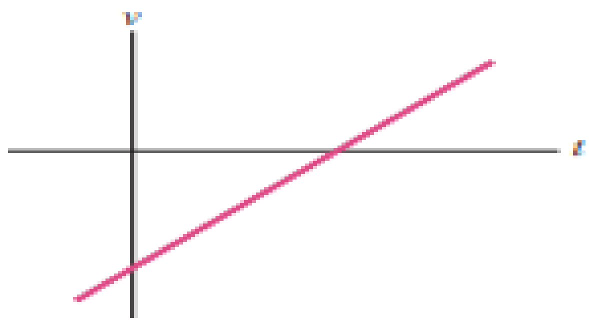

Fig: 1.

Q.2. A car traveling a[0] a[1] km/h is a[2]a[3] m from a barrier when the driver slams on the brakes. The car hits the barrier 2.00 s later.

(a) What is the magnitude of the car's constant acceleration before impact?
(b) How fast is the car traveling at impact? [5]

Q.3. Vector **a** has a magnitude of a[2] m and is directed east. Vector **b** has a magnitude of a[3] m and is directed 35° west of due north. What are: [6]

(a) the magnitude and the direction of vector (**a** + **b**)?
(b) What are the magnitude and the direction of vector (**b** – **a**)?
(c) Draw a vector diagram for each combination.

Q.4. A certain airplane has a speed of a[0] a[1] a[2] km/h and is diving at an angle of 30.0° below the horizontal when the pilot releases a radar decoy Fig: 2. The horizontal distance between the release point and the point where the decoy strikes the ground is d = a[1] a[2] a[3] m. [6]

(a) How long is the decoy in the air?
(b) How high was the release point?

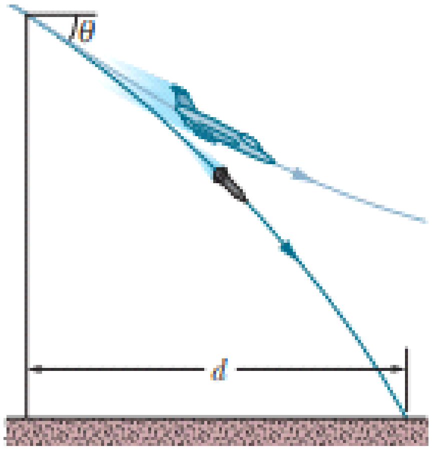

Fig: 2

Q.5. Fig: 3 shows an initially stationary block of mass m on a floor. A force of magnitude 0.a[1] a[2] mg is then applied at upward angle Θ = 20^0. What is the magnitude of the acceleration of the block across the floor if the friction coefficients are: [6]

(a) μs = 0.600 and μk = 0.500 and
(b) μs = 0.400 and μk = 0.300?

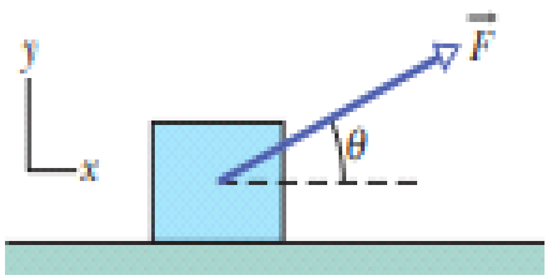

Fig: 3

Q.6. (A) (i) Which of the following relationships between a particle's acceleration a and its position x indicates simple harmonic oscillation: [2]

(a) accel: a = a[1] x^2 (b) accel: a = a[2] x (c) accel: a = - a[1] x,
(d) acel :a = - a[1] /x?

(ii) Which of the following relationships between the force F on a particle and the particle's position x gives SHM: [2]

(a) $F = -5x$, (b) $F = -400x^2$, (c) $F = 10x$, (d) $F = 3x^2$?

(B) An oscillator consists of a block of mass 0.500 kg connected to a spring. When set into oscillation with amplitude a[1]a[2] . 0 cm, the oscillator repeats its motion every 0.500 s. Find the (a) period, (b) frequency, (c) angular frequency, (d) spring constant, (e) maximum speed, and (f) magnitude of the maximum force on the block from the spring.

[5]

Q.7. (A) Fig: 4 gives a snapshot of a wave traveling in the direction of positive x along a string under tension. Four string elements are indicated by the lettered points. For each of those elements, determine whether, at the instant (at points a, b, c, d) of the snapshot, the element is moving upward or downward or is momentarily at rest.

[3]

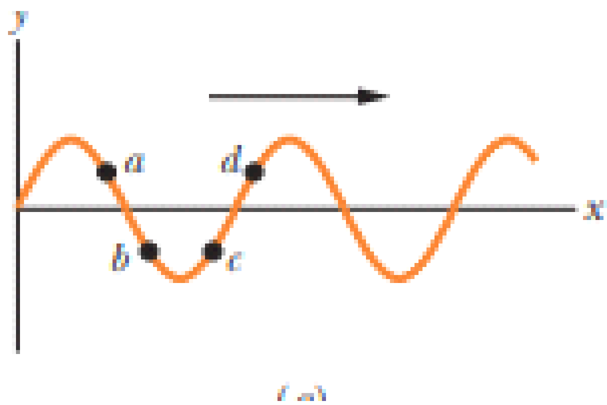

Fig: 4

(B) Two identical sinusoidal waves, $y_1(x, t)$ and $y_2(x, t)$, travel along a string in positive direction of an x axis. They interfere to give a resultant wave y (x, t). By drawing the free hand sketches show the resultant waves at following phase differences.

[6]

(a) 0^0 (b) 180^0 (π rads) and (c) 120^0 [(2/3) π rads]

Q.8. In Fig.5, particle 1 of charge +q and particle 2 of charge +4.00q are held at separation L = a[2] a[3] . 00 cm on an x axis. If particle 3 of charge + q_3 is to be located such that the three particles remain in place when released, what must be the value of x? Calculate.

[4]

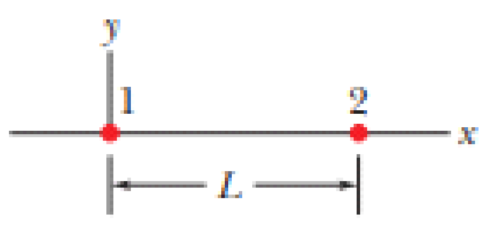

Fig: 5

Q.9. In Fig 6., the four particles form a square of edge length a = a[1] a[2] .00 cm and have charges q_1 = 10.0 nC, q_2 = - 20.0 nC, q_3 = a[2] a[3].0 nC, and q_4 = -10.0 nC. In unit vector notation, what net electric field do the particles produce at the square's center?

[6]

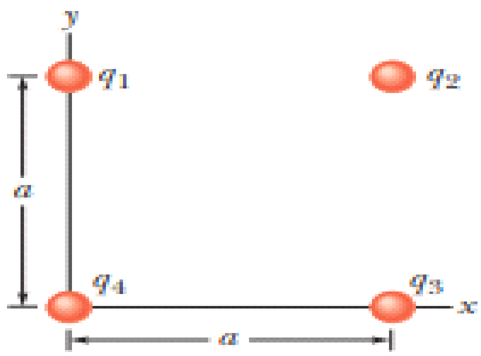

Fig: 6

Q.10. (a) Define Gauss's Law of Electricity.

[2]

(b) By applying the gausses law derive a mathematical relationship for the electric field due a line of a +ve charge at a perpendicular distance 'r' from it. Length of the line is 'h' and its charge density is λ

[4]

Q.11. (a) Define Equipotential surfaces. [2]

(b) Derive mathematical relationship for Electric potential at a distanced 'r' due to a +ve point charge 'q' . [4]

Q.12. Capacitor 1, with C_1 = a[1] .55 μF, is charged to a potential difference V_0 = 6.30 V, using a 6.30 V battery. The battery is then removed, and the capacitor is connected as in Fig:7 to an uncharged capacitor 2, with C_2 = a[2] .95 μF. When switch S is closed, charge flows between the capacitors.
Find the charge on each capacitor when equilibrium is reached.

[6]

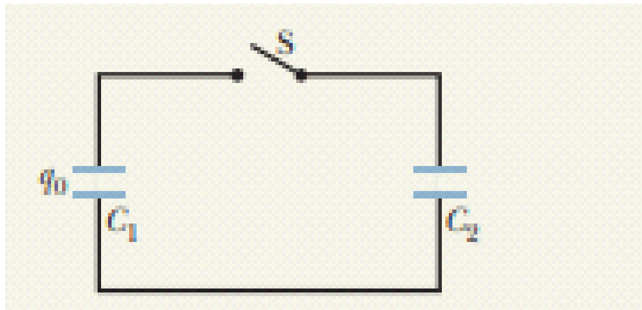

Fig: 7

Q.13. (a) Briefly define Ohm's Law [1]

(b) For the following circuit (Fig: 8) find the Potential Difference (Vb - Va) [5]

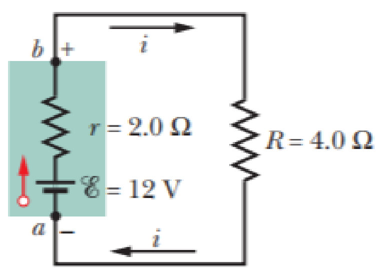

Fig: 8

Q.14 . An electron that has an instantaneous velocity of
v = (a[1] .0 x 10^6 m/s) i + (3.0 x 10^6 m/s) j is moving through the uniform magnetic field of **B** = (0.030 T) i - (0.15 T) j. [6]

(a) Find the force on the electron due to the magnetic field.
(b) Repeat your calculation for a proton having the same velocity.

Q.15. (a) Define Ampere's law of current and Faraday-Lenz's law of induction.

(b) Draw a free hand sketch of right hand rule to prove validity of Ampere's Law.

(c) Prove the validity of Faraday's law by drawing a free hand sketch of a simple experimental setup. [6]

Q.16. (a) Draw a free hand sketch of an Electromagnetic wave, by showing Electric field and the Magnetic Field waves separately in it. [4]

(b) Write the names of those laws of electromagnetism which do represent the following four Maxwell's Equations. [4]

$$\oint \vec{E} \cdot d\vec{A} = q_{\text{enc}}/\varepsilon_0$$

$$\oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$$

$$\oint \vec{B} \cdot d\vec{s} = \mu_0 \varepsilon_0 \frac{d\Phi_E}{dt} + \mu_0 i_{\text{enc}}$$

The End