# HARINGHATA MAHAVIDYALAYA

## Sem. II 1st Internal Assessment Examination - 2019

### B.Sc. (Physics Hons.)

### Sub: - PHY-H-T-CC-03,

### Subject Title – Electricity & Magnetism

### Coverage: - Electric field & potential, Magneto statics.

Submission from 08.03.2019 to 14.03.2019

Answer any two questions. Maximum Marks. 2×5=10

1.(a) Show that the lines of electric field is not closed.

(b) State and prove Earnshaw's theorem. (2+3)

2. Consider a uniformly charged sphere of radius a and charge density ρ. Show that the electric potential ϕ at an internal point is given by

$$\phi(r) = \frac{\rho a^2}{6\varepsilon_0}\left(3 - \frac{r^2}{a^2}\right) \qquad (5)$$

3. (a) What is magnetic vector potential $\vec{A}$ ?

(b) Using the concept of $\vec{A}$ establish Biot-Savart law and Ampere's circuital law. (1+4)

4. Find out divergence and curl of the magnetic field. (5)

5. Show that the path of a charged particle in a uniform magnetic field is helical. (5)

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## Sem. II 1st Internal Assessment Examination - 2019

### B.Sc. (Physics Hons.)

### Sub: - PHY-H-T-CC-04, Subject Title – Waves & Optics.

### Coverage: - Superposition wave and wave motion.

Submission from 08.03.2019 to 14.03.2019

**Answer any two (2) questions:** **Maximum Marks. 2x5=10**

1. Compound analytically two rectangular simple harmonic motions of different amplitudes and of frequencies in the ratio 2 : 1 (or period is of the ratio 1 : 2). Discuss the cases when the phase difference is 0, $\pi/2$ and $\pi$.Draw the Lissajous figures in above cases. (3 + 2)

2. a) Define the term 'Lissajous figures'. Write down the uses of it.

b) Show that the amplitude A of the displacement resulting from the superposition of N SHMs all of the same amplitude a and frequency $\omega$ but having different phase angles of $\delta_1 = \varepsilon$, $\delta_2 = 2\varepsilon$, $\delta_3 = 3\varepsilon$,……., $\delta_n = N\varepsilon$ is given by

$$A = [\, a \sin(N\varepsilon/2)/\sin(\varepsilon/2)]$$

What is the importance of this result? (2 + 3)

3. a) Find the resultant of the following two SHMs:

$$x_1 = 0.03 \cos 10\pi t,\ x_2 = 0.03 \cos 12\pi t$$

Hence find the beat frequency and beat amplitude.

b) Two mutually perpendicular oscillations are represented by

$$x(t) = a \sin \omega t \text{ and } y(t) = b \sin (2\omega t + \varphi)$$

Sketch the Lissajous figure resulting form these oscillations with $\varphi = -\pi$. Find the value of x for which the Lissajous figure touches the lines $y = \pm b$. (2 + 3)