Reg. No. | | | | | | | | | |

BSCPHCN 201

Second Semester B.Sc. Degree Examination, September 2022
(NEP 2020) (2021 – 22 Batch Onwards)
PHYSICS (DSCC)
Electricity and Magnetism

Time : 2 Hours Max. Marks : 60

Instructions : *1) Answer questions from **all** Parts.*
*2) Scientific calculators are **allowed**.*

PART – A

Answer **any four** questions. **Each** question carries **2** marks. **(4×2=8)**

1. Mention any two properties of charges.
2. State and explain Gauss' law in electrostatics.
3. What is an electrical insulator ? Give an example.
4. Define time constant in charging a capacitor.
5. What is RC Low Pass Filter ? Draw the circuit diagram.
6. Define divergence of a vector. What is its significance ?

PART – B

Answer **all** questions. **(4×10=40)**

Unit – I

7. a) Derive an expression for the electric field due to a charged spherical conductor at a point outside the sphere. **4**

   b) Derive an expression for the electric potential due to a charged spherical conductor at a point (i) outside the sphere, (ii) on the sphere and (iii) inside the sphere. **6**

OR

8. a) Define electric field intensity and electric potential. Obtain the relation connecting them. **4**

   b) Derive an expression for the electric field due to a charged infinitely long straight conductor. **6**

Unit – II

9. a) Explain electric polarization in dipoles. **4**

   b) Obtain an expression for the growth of current in a series LR circuit with a steady emf. Define time constant of the circuit. **6**

OR

10. a) Explain the effect of electric field on a conductor. **4**

    b) Obtain an expression for the charge in a CR circuit during its decay. Define time constant. **6**

Unit – III

11. a) Derive an expression for RMS value of AC in terms of peak value. **4**

    b) Discuss RC high pass filter and derive an expression for cut off frequency. **6**

OR

12. a) Write any four differences between series resonance and parallel resonance. **4**

    b) Derive an expression for Hall coefficients and Hall voltage. **6**

Unit – IV

13. a) Derive Maxwell's relation $n = \sqrt{\epsilon_r}$. **4**

    b) Derive the equation $\vec{\nabla} \times \vec{B} = \mu\left(\sigma\vec{E} + \varepsilon\frac{\delta\vec{E}}{\delta t}\right)$. **6**

OR

14. a) State Gauss and Stokes theorem. Express them in vector form. **4**

    b) Derive the wave equation for the field vectors $\vec{E}$ and $\vec{B}$. Hence arrive at the equation for the velocity of electromagnetic wave in a medium. **6**

PART – C

15. Answer **any three** questions. **Each** question carries **4** marks. **(3×4=12)**

a) Two charges $+4\mu C$ and $-1\mu C$ are kept 1m apart in air. Find the positions along the line joining the charges at which the potential is zero.

b) A parallel plate capacitor has circular plate of radius 4 mm and plates are 0.4 mm apart. Calculate capacitance of the capacitor. Find energy stored in it if a cell of emf 12 V is connected across it.

c) Calculate Hall constant and Hall mobility for sodium. Given atomic weight of sodium is 23. Its density is 970 kg/m^3 and conductivity = $2.1 \times 10^7 ohm^{-1}m^{-1}$.

d) Prove that the vector $\vec{A} = 3y^4z^2\hat{i} + 4x^3z^2\hat{j} - 3x^2y^2\hat{k}$ is solenoidal.

———————