Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Science

End Sem (Even) Examination May-2022

BC3CO16 Physics -IV

Programme: B. Sc. (CS) Branch/Specialisation: Computer Science

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The electric potential at a point at distance r from an electric dipole is proportional to: **1**

(a) 1/r (b) $1/r^2$ (c) $1/r^3$ (d) $1/r^4$

ii. The total electric flux emanating in air from a unit positive charge is: **1**

(a) ε_0 (b) $1/\varepsilon_0$ (c) $1/4\pi\varepsilon_0$ (d) $4\pi\varepsilon_0$

iii. The current which can be measured by an ammeter, are called: **1**

(a) Free currents (b) Bound currents

(c) Both (a) and (b) (d) None of these

iv. The ratio of intensities of magnetic field at the center and at external end of a current carrying solenoid is: **1**

(a) 2:1 (b) 1:2 (c) 4:1 (d) 1:4

v. Kirchhoff's law are applicable in: **1**

(a) Only the DC circuits (b) Only the AC circuits

(c) Both (a) and (b) (d) None of these

vi. For more Q value of a resonant LCR circuit **1**

(a) Reactance of inductance should be low

(b) Ohmic resistance should be low

(c) Reactance of capacitance should be low

(d) Impedance should be high

vii. Accelerator is used: **1**

(a) To increase the velocity of neutrons

(b) For the detection of ionizing particles

(c) To obtain electrons of energy 1000 MeV

(d) To increase the energy of charged particles

P.T.O.

viii. The simplest mass spectrograph was given by: **1**
(a) J.J. Thomsan (b) Newton (c) Einstein (d) Chadwick

ix. Varying current can induce voltage because the magnetic field produced by it is: **1**
(a) Varying with time
(b) Constant
(c) Stronger than DC
(d) Of closed loop nature

x. The following is not the electromagnetic wave: **1**
(a) X-rays (b) Infrared rays
(c) Ultraviolet rays (d) Cathode rays

Q.2 i. Define intensity of electric field and electric potential. Write the relationship between them. **2**

ii. Derive Poisson's and Laplace's equations in electrostatics. **3**

iii. Define the displacement vector D and deduce the relation between D and E. **5**

OR iv. Three charges +q, +2q and -4q coulomb are placed at the corners A, B and C respectively of an isosceles triangle of side a meter. Calculate the electrostatic potential energy of the system. **5**

Q.3 i. A charge q is uniformly distributed in the volume of a sphere of ratio r. If the sphere is rotating with a uniform angular velocity ω about its diameter, find the magnetic moment of charge distribution. **2**

ii. Show that the magnetic field does not change the kinetic energy of the particle. **3**

iii. What is Lorentz force? On its basis deduce the expression for the force acting on a current carrying conductor in a magnetic field. **5**

OR iv. Explain the meaning of the terms B, H and M establish a relationship between them. **5**

Q.4 i. What are steady and non- steady currents? Derive equations of continuity for them. **2**

ii. Explain the growth and decay of current in L-R circuit. **3**

iii. Give the mathematical treatment of charging of a condenser in LCR circuit connected to DC source. **5**

OR iv. Write a short note on: **5**
(a) Wattless current (b) Resonance
(c) Quality factor (d) Choke coil

Q.5 i. What is velocity selector? Draw its neat diagram. **2**

ii. Explain the principles of mass spectrograph. **3**

iii. Describe the construction and working of a cathode ray oscilloscope? Deduce its expression and state the factors on which it depends. **5**

OR iv. Explain the construction and working of cyclotron with the help of a labelled diagram. Obtain expression for the maximum kinetic energy acquired by the particle. **5**

Q.6 Attempt any two:

i. A dielectric medium is kept in a variable electric field. Show that the displacement current is equal to the conduction (or free) current and also Prove that div B = 0. **5**

ii. What is Poynting's theorem? State and prove it. **5**

iii. Write down the Maxwell's equations in an isotropic medium and deduce them. **5**

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Marking Scheme
BC3CO16 Physics -IV

1	i.	The electric potential at a point at distance r from an electric dipole is proportional to: (b) $1/r^2$		**1**
	ii.	The total electric flux emanating in air from a unit positive charge is: (b) $1/\varepsilon_0$		**1**
	iii.	The current which can be measured by an ammeter, are called: (a) Free currents		**1**
	iv.	The ratio of intensities of magnetic field at the center and at external end of a current carrying solenoid is: (a) 2:1		**1**
	v.	Kirchhoff's law are applicable in: (c) Both (a) and (b)		**1**
	vi.	For more Q value of a resonant LCR circuit (a) Reactance of inductance should be low		**1**
	vii.	Accelerator is used: (d) To increase the energy of charged particles		**1**
	viii.	The simplest mass spectrograph was given by: (a) J.J. Thomsan		**1**
	ix.	Varying current can induce voltage because the magnetic field produced by it is: (a) Varying with time		**1**
	x.	The following is not the electromagnetic wave: (d) Cathode rays		**1**
Q.2	i.	Electric field and Electric potential	1 Mark	**2**
		Relationship between Electric field and Electric potential	1 Mark	
	ii.	Poisson's equations	1.5 Marks	**3**
		Laplace's equations	1.5 Marks	
	iii.	Displacement vector D	2 Marks	**5**
		Relation between D and E.	3 Marks	
OR	iv.	Students has to write all derivative steps and final result is= $-(1/4\pi\epsilon_o) \times (10q^{2/a})$ Joule		**5**
	i.	As per the explanation	3 Marks	**3**
	ii.	Lorentz force	2 Marks	**5**
		Derivation	3 Marks	
OR	iii.	Terms B, H and M	2.5 Marks	**5**
		Relationship	2.5 Marks	
Q.4	i.	Steady and non- steady currents	0.5 Mark	**2**
		Equations of continuity	1.5 Marks	
	ii.	As per the explanation	3 Marks	**3**
	iii.	As per the explanation	5 Marks	**5**
OR	iv.	(a) Wattless current		**5**
		Statement	1 Mark	
		(b) Resonance		
		Statement	0.5 Mark	
		Expression	0.5 Mark	
		(c) Quality factor		
		Statement	0.5 Mark	
		Expression	0.5 Mark	
		(d) Choke coil		
		Statement	1 Mark	
		Diagram	1 Mark	
Q.5	i.	Velocity selector	1 Mark	**2**
		Diagram.	1 Mark	
	ii.	As per the explanation	3 Marks	**3**
	iii.	Construction	1 Mark	**5**
		Working	1.5 Marks	
		Expression	1.5 Marks	
		Factors	1 Mark	
OR	iv.	Construction	1 Mark	**5**
		Working	1 Marks	
		Diagram	1 Marks	
		Expression	2 Mark	
Q.6		Attempt any two:		
	i.	Displacement current	0.5 Mark	**5**
		Conduction current	0.5 mark	
		Displacement current is equal to the conduction	2 Marks	
		Div B = 0.	2 Marks	
	ii.	Poynting's theorem		**5**
		Statement	1 Mark	
		Theorem	4 Marks	
	iii.	Maxwell's equations	1 Mark	**5**
		Derivation of I equation	1 Mark	
		Derivation of II equation	1 Mark	
		Derivation of III equation	1 Mark	
		Derivation of IV equation	1 Mark	

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