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

BSCPHC 281

Choice Based Credit System IV Semester B.Sc. Examination, September 2022
(2020-21 Batch Onwards)
PHYSICS
Electricity and X-ray Crystallography

Time : 3 Hours Max. Marks : 80

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

PART – A

1. Answer **any eight** of the following : **(1×8=8)**
   a) What is the internal resistance of an ideal current source ?
   b) What are transient currents ?
   c) State superposition theorem.
   d) What is wattless current ?
   e) What is band pass filter ?
   f) Define magnetic flux density.
   g) What is damping in B.G ?
   h) What are Miller Indices ?
   i) State Bragg's law.

2. Answer **any six** of the following : **(2×6=12)**
   a) Show that L/R has dimension of time.
   b) State Kirchhoff's laws.
   c) Why a series LCR circuit called an acceptor circuit ?
   d) Distinguish between Inductive reactance and Capacitive reactance.
   e) What is magnetic dipole and magnetic dipole moment ?
   f) Define charge sensitivity of a B.G and write its unit.
   g) State and explain Mosley's law.
   h) Explain isotopic effect in a super conductor.

P.T.O.

PART – B

Unit – I

3. a) Derive an expression for the growth of charge in a CR circuit. **4**

   b) State Norton's theorem. Explain the method of Nortonising the circuit. Explain how Thevenin's equivalent can be obtained from Norton's equivalent. **7**

OR

4. a) State and prove maximum power transfer theorem. **4**

   b) Give the theory of discharging of a capacitor in LCR circuit. **7**

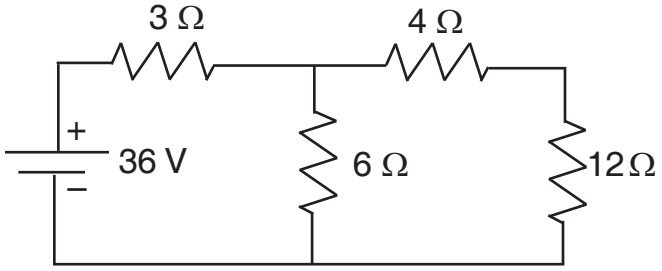
5. a) A battery of emf 100 V is connected in series with an inductance of 100 mH and a capacitor of 0.05 μF and a resistor of 100 Ω. Find :

   i) The frequency of the oscillatory current

   ii) The final charge on the capacitor. **4**

OR

   b) Apply Thevenin's theorem to find the current through 12 Ω resistor of the circuit. **4**



Unit – II

6. a) Obtain the relationship between rms value and peak value of current. **4**

   b) Derive an expression for the current in a series LCR circuit. Hence obtain the expression for resonance frequency. **7**

OR

7. a) Derive an expression for Power in an AC circuit. **4**

   b) Discuss about RC Low pass filter and derive an expression for cut-off frequency. **7**

8. a) An AC circuit consists of a coil of resistance 15 Ω and inductive reactance 20 Ω and is worked at 200 V, 50 Hz supply. Find the value of current and phase lag. **4**

OR

b) A circuit contains capacitor of 50 μF, an inductance of 5 H and a resistor of 15 Ω all in series with a 220 V, 50 Hz AC supply. Calculate the resonant frequency and Q-factor of a series LCR circuit. **4**

Unit – III

9. a) Obtain the formula for the force on a current carrying conductor placed in a magnetic field. **4**

b) Give the theory of B.G and obtain an expression for the charge passing through it. **7**

OR

10. a) Give the theory of De-Sauty bridge to find the ratio of capacitances. **4**

b) Give the theory of Anderson's bridge. **7**

11. a) A condenser is charged to a potential of 2 V and then discharged through a B.G giving a throw of 10 cm. If its period is 7.2s and the current sensitivity is $\frac{1}{30}\mu$A/cm. Calculate the capacitance of the condenser. **4**

OR

b) A circular coil of area 5 cm^2 and having 100 turns is placed in a uniform magnetic field of 1.5 T. When a current of 0.2 A is passed through the coil, find the magnetic dipole moment of the coil and maximum torque produced. **4**

Unit – IV

12. a) Explain the origin of characteristic X-rays. **4**

b) What is superconductivity and transition temperature ? Explain Meissner effect and the action of external magnetic field on a superconductor. **7**

OR

13. a) Explain two applications of superconductor. **4**

    b) Describe Bragg's Spectrometer and explain how it is used to determine the wavelength of X-rays. **7**

14. a) Monochromatic X-ray beam of wavelength 0.7A° undergo first order Bragg's reflection from the plane (302) of a cubic crystal at a glancing angle of 39°7′19″. Calculate the lattice constant. **4**

    OR

    b) First order Braggs reflection occurs when monochromatic beam of X-rays of wavelength 0.675A° is incident on a crystal at a glancing angle of 4° 51′. What is the glancing angle for third order Bragg reflection to occur ? **4**
