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

BSCPHC 253

Credit Based IV Semester B.Sc. Degree Examination, September 2022
(2019 – 20 and Earlier Batches)
PHYSICS
Electricity and X-Ray Crystallography

Time : 3 Hours Max. Marks : 80

Instructions : *i) Answer questions from **all** Parts.*
*ii) Answers to the multiple choice questions should be written on the **first page** of the answer book.*
*iii) Scientific calculators are **allowed**.*

PART – A

1. Answer the following questions by choosing the most appropriate answer. **(1×10=10)**

i) Under maximum power transfer conditions, the operating efficiency is
a) 25% b) 50% c) 75% d) 100%

ii) Internal resistance of an ideal current source is
a) Infinity b) Very high
c) Very low d) Zero

iii) The time constant of RC circuit is
a) $\frac{R}{C}$ b) $\frac{C}{R}$ c) RC d) R^2C

iv) Form factor for DC is
a) 1 b) 1.11 c) 1.21 d) 1.31

v) The power factor of a pure capacitor is
a) Zero b) Maximum c) Minimum d) One

vi) Bandwidth of a series resonance circuits
a) $Q_0 f_0$ b) $\frac{R}{2\pi L}$ c) $\frac{R}{4\pi L}$ d) None of these

vii) The SI unit of magnetic flux density is
a) Weber b) Tesla c) Weber/m^3 d) Weber/m^4

viii) The presence of high resistance in series with BG prevents excessive

a) Swings b) Damping

c) Throw d) None

ix) The transition temperature of mercury is

a) 1 K b) 1.14 K

c) 4.12 K d) 9.22 K

x) The longer wavelength end of X-ray spectrum is known as

a) Hard X-ray b) Soft X-ray

c) Black X-ray d) White X-ray

2. Answer **any five** of the following. **(2×5=10)**

a) Show that L/R has the dimensions of time.

b) Define node and loop.

c) What is sharpness of resonance ? Explain.

d) Give Lorentz force relation.

e) How is damping reduced in a B.G. ?

f) Explain Meissner effect.

g) State and explain Duane-Hunt's law.

PART – B

UNIT – I

3. a) Explain the method of Nortonising a circuit. **4**

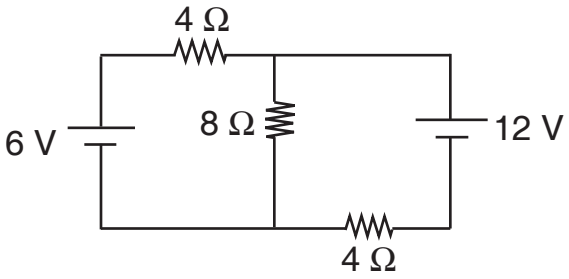
b) Give the theory of discharge of a capacitor in LCR circuit. **6**

OR

4. a) Obtain an expression for decay of charge in a CR circuit. Define time constant of the circuit. **4**

b) State and prove maximum power transfer theorem. Mention two applications of maximum power transfer theorem. **6**

5. a) Using superposition theorem, determine the current through the resistor. **5**



OR

b) A condenser of capacity 0.5 μF and leakage resistance 10 MΩ is charged to a certain potential and then discharged. Find the time the potential will take fall to half its original value. **5**

UNIT – II

6. a) Obtain an expression for current in LR circuit. **4**

b) Derive an expression for current in a series LCR circuit hence obtain the expression for resonant frequency. **6**

OR

7. a) Obtain the relationship between rms value and peak value of AC. **4**

b) Compare series resonance and parallel resonance. **6**

8. a) A simple low pass RC filter having a cut off frequency of 1 KHz is connected to a AC source of 10 V with variable frequency. Calculate the value of C if R = 10 KΩ. **5**

OR

b) An inductor of 200 mH and a resistor of 100 Ω are connected in series to an AC source of 230 V, 50 Hz. Calculate the impedance, current and phase angle. **5**

UNIT – III

9. a) Describe a B.G. with a neat diagram. **4**

b) Give the theory of Anderson's bridge. **6**

OR

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

b) Derive the expression for torque on a current loop in a magnetic field. Hence show that a coil behaves as a magnetic dipole. **6**

11. a) A proton of energy 5 MeV is moving vertically downwards in a uniform horizontal magnetic field of 2T. Find the magnitude of the force acting on it. Given : mass of the proton = 1.7×10^{-27} kg, charge of proton = 1.6×10^{-19} C. **5**

OR

b) A condenser is charged to a potential of 2 V and then discharged through B.G. giving a throw of 10 cm. If its period is 7.2 S and current sensitivity is 130 μA/cm. Calculate the capacitance of the condenser. **5**

UNIT – IV

12. a) What are Miller indices ? Illustrate with one example. **4**

b) Explain any two important uses of superconductors and mention any three properties of superconductor. **6**

OR

13. a) What is superconductivity ? Write a note on high temperature superconductivity. **4**

b) Explain the origin of continuous and characteristic X-rays. **6**

14. a) An X-ray machine has an accelerating voltage of 25 KV. Find the shortest wavelength present in the X-ray spectrum and also evaluate its frequency as well as the energy of photon.
Given : h = 6.625×10^{-34} Js, C = 3×10^{8} m/s, e = 1.6×10^{-19} C. **5**

OR

b) X-rays of wavelength 0.71 Å are reflected from the (1 1 0) plane of a rock salt crystal (a = 2.82 Å). Calculate the glancing angle corresponding to second order reflection. **5**

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