QP – 221

# Third Semester B.Sc. Examination, April/May 2021
## (F+R) (CBCS) (2017 – 18 and Onwards)
## PHYSICS – III
## Electricity and Magnetism

Time : 3 Hours Max. Marks : 70

***Instructions*** : *i) Answer **any five** questions from **each** Part.*
*ii) Non programmable scientific calculators are **allowed**.*

PART – A

Answer **any five** questions. **Each** question carries **eight** marks. **(5×8=40)**

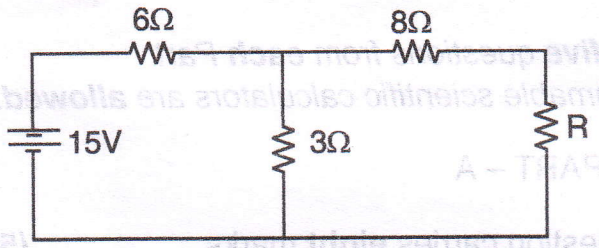
1. State and prove superposition theorem.
2. a) Discuss the decay of charge in C-R circuit, hence define time constant. Represent the same graphically.
   b) Derive an expression for energy stored in an inductor. **(5+3=8)**
3. a) State and explain Biot-Savart's law.
   b) Derive an expression for torque on a current loop placed in a uniform magnetic field. **(3+5=8)**
4. a) Mention the conditions for moving coil galvanometer to be dead beat and ballistic.
   b) Explain how a BG can be used to determine high resistance by leakage. **(2+6=8)**
5. a) State and explain Stoke's theorem.
   b) Derive Maxwell's equation $\vec{\nabla}\times\vec{E}=-\frac{\partial\vec{B}}{\partial t}$ and discuss the physical significance. **(2+6=8)**
6. a) Define Poynting vector.
   b) Show that electromagnetic waves are transverse in nature. **(2+6=8)**
7. a) Mention the conditions under which AC bridges balanced.
   b) Derive an expression for self inductance of a coil using Maxwell's bridge. **(3+5=8)**
8. a) What is Thomson effect ? Distinguish between positive and negative effects.
   b) How do you calculate the value of Thomson coefficient from thermo-electric diagram ? **(3+5=8)**

P.T.O.

## PART – B

Solve **any five** problems. **Each** problem carries **four** marks.

9. Calculate the value of R for maximum power to transfer and the maximum power delivered to it.




10. A coil of self inductance 10 H is in series with a resistance of 100 Ω, connected 100V dc supply. Calculate the time constant and instantaneous current after time interval of 0.1 s.

11. An electron after being accelerated through a p.d. of 15 kV, enters a uniform magnetic field of 0.04T, perpendicular to its direction of motion. Calculate the radius of curvature of its trajectory [e = $1.6\times10^{-19}$C, m = $9.1\times10^{-31}$ kg].

12. A long solenoid of length 1m and radius of cross section 1.5 cm has five layers of windings 850 turns each. If the solenoid carries current of 6A, calculate the value of magnetic field and magnetic flux through cross section at its centre.

13. Find the divergence of $\vec{A}$ at a point (1, –1, 1) where $\vec{A} = x^2z\hat{i} - 2y^3z^2\hat{j} + xy^2z\hat{k}$.

14. If the electric field between a parallel plate air capacitor of area 1.5$m^2$ changes at the rate of $10^6 Vm^{-1}s^{-1}$, calculate the displacement current.

15. A capacitor 2 μF and a resistor are connected to 240 V, 50 Hz ac in series. If the p.d. across resistor is equal to p.d. across capacitor. Calculate the resistance of the coil.

16. The thermo emf of a thermocouple in microvolts is given by the equation $e = 16.34\theta - 0.021\theta^2$ when the junctions are at 0°C and θ°C. Calculate
    i) thermo electric power at 100°C.
    ii) the peltier emf at 100°C.

## PART – C

17. Answer **any five** questions. **Each** question carries **two** marks. **(5×2=10)**

a) Is it possible to construct ideal voltage source ? Explain.

b) Is the law of conservation of energy violated due to production of back emf in L-R circuit ? Explain.

c) Does an electric charge kept near a strong magnet experience force ? Explain.

d) What is the advantage of having two coils in Helmholtz tangent galvanometer ?

e) When is the given vector function irrotational ? Explain.

f) How does the displacement current changes, when the applied frequency is changed in a capacitor ?

g) Does resonant frequency of series LCR circuit depends upon resistance ? Explain.

h) Does thermo-electric effect obey the law of conservation of energy ?

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