

B.Sc. (Regular) DEGREE EXAMINATION, MARCH 2009.

(Examination at the end of Third Year)

Part II – Physics

Paper IV – ELECTRICITY, MAGNETISM AND ELECTRONICS

(For Mathematics Students)

Time: Three hours

Maximum: 100 marks

PART A – (2 x 15 = 30 marks)

Answer any TWO questions.

1. State and prove Gauss law. Derive an expression for the electric field due to charged cylinder at a point (a) inside the cylinder and (b) outside it.
2. Derive the capacitance of a capacitor without and with dielectric between the plates of a capacitor.
3. Explain Biot-Savarts law. Derive an expression for the magnetic induction at a point on the axis of a circular coil carrying current.
4. Explain the construction, working and theory of a ballistic Galvanometer.

PART B – (2 X 15 = 30 marks)

Answer any TWO questions.

5. Derive an expression for the growth and decay of current in L-R circuit.
6. Derive Maxwell's electromagnetic equation in differential form. Deduce equation of electromagnetic waves.
7. Describe with a neat circuit, the determination of h-parameters of a transistor from its characteristic curves.
8. Explain the functioning of Half-adder and Full-adder along with truth tables.

PART C – (5 x 4 = 20 marks)

Answer any FIVE questions.

9. Derive an expression for the mechanical force acting on the surface of a charged conductor.
10. Derive an expression for the potential energy of a dipole in an electric field.
11. Explain Hall effect.
12. Explain Faradays Laws of electromagnetic induction.
13. Write a short note on Q-factor.
14. Explain the basic laws of electricity and magnetism.
15. Explain the working of NPN transistor.
16. State Demorgans theorems.

PART D – (4 x 5 = 20)

Answer any FOUR questions.

17. The dielectric constant of medium is 4. Electric field in the dielectric is 106 V/M. Calculate electric displacement and polarization. (Take $\epsilon_0 = 9 \times 10^{-12}$ F/M).
18. Calculate the energy stored in a spherical capacitor of 2 m radius charged to a potential of 3000 volt.
19. The magnetic susceptibility of the medium is 948×10^{-11} . Calculate permeability and relative permeability.
20. A 50 cm long solenoid having 500 turns and radius 2 cm is wound on an iron core of relative permeability 800. What will be the average emf induced in the solenoid if the current in it changes from 0 to 2 amp in 0.5 seconds.
21. Calculate the resonant frequency of an LCR parallel resonant circuit with $L = 10$ mH., $C = 1\mu\text{F}$ and $R = 1\Omega$.
22. An infinite long conductor carries current of 100mA. Find the magnetic field at a point 10 cm away from it.
23. In a transistor, base current and emitter current are 0.08 mA and 9.6 mA respectively. Calculate collector current, α and β .
24. Convert the given binary numbers into decimal numbers:
 - (a) 100112
 - (b) 11002