23/3/17

DOON UNIVERSITY, DEHRADUN

Mid Semester Examination, Second Semester, 2016-17

School of Physical Sciences

Core Physics test paper of 5 Years (Integrated) MSc Programmes

Course: PHC-151: Electricity & Magnetism

Time Allowed: 2Hours *Maximum Marks: 30*

Note: Attempt All Questions from Sections A, B, C.

SECTION: A *(Marks: 1 X 6 =6)*

1. Define static and dynamic resistance.
2. State Kirchhoff's current law.
3. By saying that the electrostatic field is conservative, we do not mean that
   (a) It is the gradient of a scalar function (∇.V) (b) Its circulation is identically zero
   (c)The work done in a closed path inside the field is zero (d) The potential difference between any two points is zero
4. The dielectric constant of a polar dielectric (a) higher (b) smaller (d) same as that of a non polar molecule.
5. Why is the Electric field inside a conductor zero?
6. Why are electric field lines perpendicular to the surface of the conductor?

SECTION: B *(Marks: 12)*

7. Draw frequency versus current for parallel LCR resonant network. Write expression for its admittance.
8. A series RC circuit have C = 10μF, R=120 Ω and V= 100V at 50 Hz. Calculate phase, current and power in the circuit.

OR

9. Using superposition theorem, determine current in 3 Ω resistance.

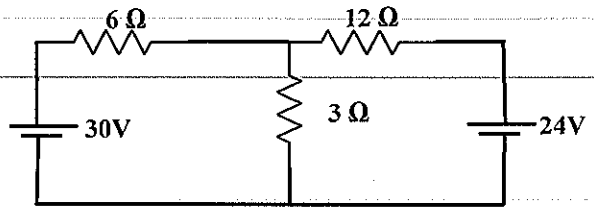

Figure 1

10. For following circuit, what should be value of R_L for maximum power transfer and calculate the value of power for the following circuit.

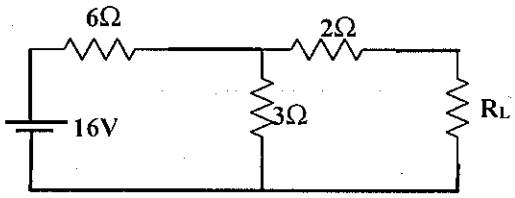

Figure 2

11. What is an isolated conductor? Derive the capacitance of an isolated spherical conductor of radius 2R and charge Q/4.
12. Explain the behaviour of a dielectric material when it is placed in a uniform electric field between the two plates of a capacitor.

SECTION: C *(Marks: 12)*

13. Derive the expression for Gauss's law. What are the two forms of the law?
14. Derive the Electric field for a spherical shell of inner radius a and outer radius b, using Gauss law for the following three regions:
    a. $r < a$
    b. $a < r < b$
    c. $r > b$
15. Solve the following:

(a) The potential of a certain charge configuration is expressed by $V= 2x + 12y^2+ 2yz$. Find the electric field intensity at (2, 2, 1).

(b) Suppose a point charge +q is held at a distance d above an infinite grounded conducting plane connected to earth.

(i) What is the potential in the region above the plane?

(ii) Two semi-infinite grounded conducting planes meet at right angles. In the region between them, there is a point charge q. What is the potential?

16. How uniqueness theorem is applied for conductors. Differentiate between Poisson's and Laplace equation. How does Poisson's equation behave for a conductor?