

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

FIRST YEAR [BATCH 2015-18]

B.A./B.Sc. SECOND SEMESTER (January – June) 2016

Mid-Semester Examination, March 2016

Date : 19/03/2016

PHYSICS (General)

Time : 12 noon – 1 pm

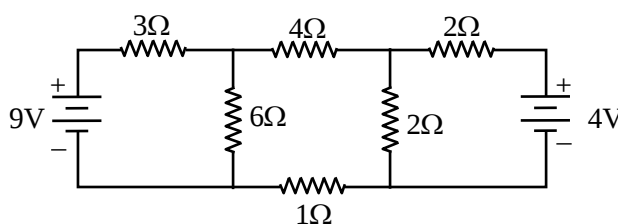
Paper : II

Full Marks : 25

Answer any five questions :

[5×5]

1. a) Prove : $\text{div. curl } \vec{F} = 0$. where $\vec{F}$ is a function of x, y, z . [2]
b) A vector field is given by $\vec{A} = (x^2 + xy^2)\hat{i} + (y^2 + x^2y)\hat{j}$. Show that the field is irrotational and find the scalar potential. [1+2]
2. a) Write Gauss's theorem. [1]
b) Find electric field due to symmetric charge distribution at the surface of a charged conductor. [3]
c) Write divergence theorem (only mathematical form). [1]
3. Explain the three vectors electric intensity ($\vec{E}$), Electric polarisation ($\vec{P}$), displacement ($\vec{D}$) and establish the relation $\vec{D} = \epsilon \cdot \vec{E} + \vec{P}$. [5]
4. Explain what is meant by the degrees of freedom of a mechanical system. Show that if a molecule has 'f' degrees of freedom, the ratio γ of its specific heats is given by : $\gamma = 1 + 2/f$. Also find the ratio of specific heats for a linear triatomic gas. [5]
5. Graphically represent in a figure the nature of Maxwell distribution curve for Helium, Neon and Argon at 298 K.
If the density of planet is $5.5 \times 10^5 \text{ kg/m}^3$ and its temperature is 27°C . Find the maximum radius for the planet which can retain oxygen in its atmosphere. [5]
6. Deduce the critical constants in terms of Van-der-Waal's constants. Define critical coefficient and explain how it is different from experimentally observed values for different gases. [5]
7. In the circuit given below, find by applying Thevenin's theorem, the voltage across the 4Ω resistor. [5]



8. a) Find an expression of current flowing through an LR circuit at any time after the battery of emf V is switched on, show the result graphically. [3]
b) A coil of inductance 2H and resistance 50Ω is connected in series with a resistance of 50Ω . Calculate the time constant of the circuit. If a 5V battery is switched on the circuit at $t = 0$, determine the maximum rate of growth of current. [2]