Series.	K I	R II	M III	GIV

Roll No.		1	9

Code No.-1/1/1

Candidate must write the Code No. on the title page of the answer book.

- Please check that this question paper contains **4** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **26** questions.
- Please write down the Serial Number of the question before attempting it.

FIRST TERM EXAMINATION 2016 -17
SUBJECT CODE - 042

Time allowed: **3 Hours** Maximum Marks: **70**

General Instruction:

(a) All questions are compulsory.

(b) There are 26 questions in total. Questions 1 to 5 carry one mark each, questions 6 to 10 carry two marks each, questions 11 to 22 carry three marks each question no. 23 carry four marks and questions 24 to 26 carry five marks each.

(c) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and one question of five marks each.

(d)Use of calculators is not permitted.

(e)You may use the following physical constants wherever necessary:

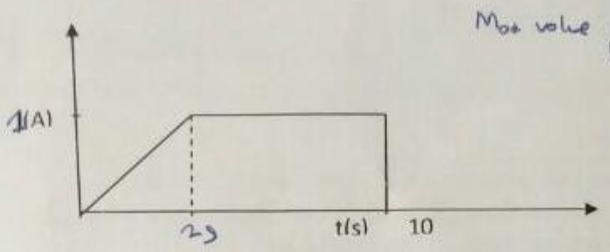
$c = 3X\ 10^{8}\ m/s$	Mass of electron $=9.1X\ 10^{-31} kg$
$h = 6.6 \times 10^{-34}\ Js$	Mass of neutron $=1.67 \times 10^{-27} kg$
$e = 1.6 \times 10^{-19}\ C$	Boltzmann's constant $= 1.38 \times 10^{-23}\ J/K$
$\mu_0 = 4\Pi \times 10^{-7}\ TmA^{-1}$	Avogadro Number $=6.023 \times 10^{23}\ /mol$

1. Show diagrammatically the configuration of stable and unstable equilibrium of an electric dipole ($\vec{p}$) placed in a uniform electric field ($\vec{E}$).
2. Can two equipotential surfaces intersect? Justify your answer.
3. Write the characteristics of manganin which make it suitable for making standard resistance.
4. A plane electromagnetic wave travels in vacuum, along the Y direction. Write down the direction of its electric and magnetic field vectors.

5. Why does the bluish colour predominate in a clear sky?

6. Calculate the force between two alpha particles kept at a distance of 0.02mm in air.

7. The plot in fig given below shows the variation of current I through the cross section of a wire over a time interval of 10s. Find the amount of charge that flows through the wire over this time period.



8. You are given a low resistance R_1,a high resistance R_2 and a moving coil galvanometer. Suggest how would you use these to have an instrument that will be able to measure (i) current (ii) potential difference.

OR

What is the ratio of initial and final resistances, when a metallic wire of length l is stretched to double its length, assuming no change in density on stretching?

9. Define Ampere's circuital law; derive an expression for the magnetic field at the centre of the long solenoid.

10. How does the power of a convex lens vary, if the incident red light is replaced by violet light?

11. Net capacitance of three identical capacitors in series is 1μf. What will be their net capacitance if connected in parallel?

Find the ratio of energy stored in the two configurations, if they are both connected to the same source.

12. Two point charges +10uC and -10uC are separated by a distance of 40 cm in air

(i) Calculate the electrostatic potential energy of the system assuming the zero of the potential energy to be at the infinity.

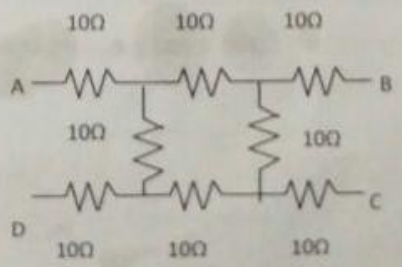
(ii) Draw an equipotential surface of the system.

OR

Find the expression for the electric field strength at a distant point situated (i) on the axis and (ii) along the equatorial line of an electric dipole.

13. Using Gauss's law prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it.

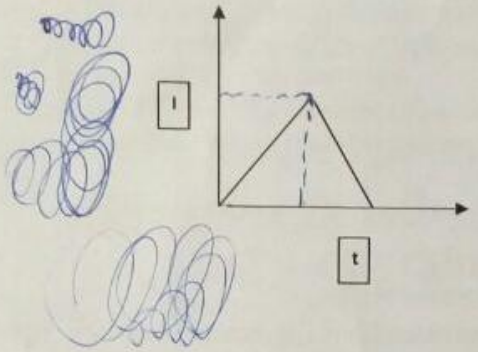
14. Find the resistance between the points (i) A and B and (ii) A and C in the following network



15. Distinguish the magnetic properties of dia, Para and ferromagnetic materials on the basis of
a) Susceptibility b) Magnetic Permeability b) Coercivity

16. Two coils have a mutual inductance of 0.005H. The current changes in the first coil according to the equation $I = I_0 \sin \omega t$ where $I_0 = 10A$ and $\omega = 100\pi$ rad/s. Calculate the maximum value of e.m.f in the second coil.

17.The graph below shows the variation of I with t. If it is given to the primary of a transformer, what is the nature of induced e.m.f in the secondary?



18. A fan blade of length 0.5 m rotates perpendicular to a magnetic field of 5×10^{-5} T. If the e.m.f induced between the centre and the end of the blade is 10^{-2} V . Find the rate of rotation.

19 Electromagnetic waves with wavelength

(i) λ_1, are used to treat muscular strain.

(ii) λ_2, are used by a FM radio station for broadcasting..

(iii) λ_3, are produced by bombarding metal target by high speed electrons.

(iv) λ_4, are observed by the ozone layer of the atmosphere.

Identify and name the part of electromagnetic spectrum to which these radiation belong. Arrange these wave lengths, in decreasing order of magnitude.

20. An object is placed at O in a medium (n_1). Draw a ray diagram for the image formation and hence deduce a relation between u, v and R. ($n_2 > n_1$).

$$\frac{n_1}{v} - \frac{n_2}{u} = \frac{n_1 - n_2}{R}$$

21. A small bulb is placed at the bottom of a tank containing water to a depth of 80cm. What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water= 4/3

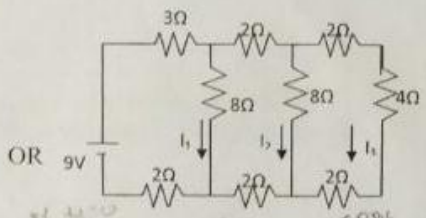
22. State the conditions for total internal reflection to occur and calculate the speed of light in a medium whose critical angle=45°

23. Rahul after having lived in US for 12years returned back to India. He had a discussion with his cousin Sumit on domestic power supply in US and in India. In US domestic power supply is at 110 V, 50Hz, whereas in India it is 220V, 50Hz. Rahul was stressing that US supply is better than Indian supply. Both went to Sumit's father an electrical Engineer and asked his opinion on the issue. He explained that both the supplies have advantages as well as disadvantages.

i) What values are used by Rahul and Sumit?

ii) Write one advantage and one disadvantage of 220V supply over 110V supply

24. In the circuit, find the current through the 4Ω resistor.



i)Derive condition of balance of a Wheatstone bridge.

ii) A battery of emf 10V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed?

25.(i) A long wire is first bent into a circular coil of one turn and then into a circular coil of smaller radius having n turns. If the same current passes in both the cases, find the ratio of the magnetic fields produced at the centres in the two cases.

(ii) In an LCR circuit the potential difference between terminals of inductance 60V, between terminals of capacitor 40V and between the terminals of resistor is 40V. Find the supply voltage.

OR

(i) Define self inductance. Write its SI units. Derive an expression for self inductance of a long solenoid of length l, cross sectional area A having N number of turns.

(ii) A power transmission line feeds input power at 2400 V to a step down ideal transformer having 4000 turns in its primary. What should be number of turns in its secondary to get power output at 240V?

26. (i) The velocity of light in flint glass for wavelengths 400nm and 700nm are 1.80×10^8 m/s and 1.86×10^8 m/s respectively. Find the minimum angle of deviation of an equilateral prism made of flint glass for the given wavelengths.

(ii) State Brewster's Law and deduce the expression for polarising angle.

Find expression of dispersive power of a prism

OR

(i) Draw a neat labeled ray diagram of a astronomical telescope. Deduce expression for magnification.

(ii) Two thin converging lens of focal lengths 15 cm and 30 cm respectively are held in contact with each other. Calculate power and focal length of the combination.