12D

ARMY PUBLIC SCHOOL

HALF YEARLY EXAM (2016-17)
CLASS - XII
SUBJECT : PHYSICS (THEORY)

Time : 3 Hrs **M.M. : 70**

General Instructions

1. All questions are compulsory.
2. Q. No. 1 to Q. No. 5 Carrying 1 marks each.
3. Q. No. 6 to Q. No. 10 Carrying 2 marks each.
4. Q. No. 11 to Q. No. 22 Carrying 3 marks each.
5. Q. No. 23 Carrying 4 marks.
6. Q. No. 24 to Q. No. 26 Carrying 5 marks each.
7. There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three question of five marks each. You have to attempt only one of the given choices in such questions.
8. Use log tables, if necessary. Use of calculators is not permitted.
9. You may use the following values of physical constants wherever necessary:

$$c = 3\times10^{8}\ ms^{-1}$$
$$h = 6.626\times10^{-34}\ Js$$
$$e = 1.602\times10^{-19}\ C$$
$$\mu_0 = 4\pi\times10^{-7}\ TmA^{-1}$$
$$1/4\pi\epsilon_0 = 9\times10^{9}\ Nm^2C^{-2}$$

SECTION A

1. The instantaneous current and voltage of an a.c circuit are given by $I = 20 \sin 628t$ amperes and $V = 30 \sin (628t + \pi/2)$ volts. What is the power dissipation in the circuit? (1)
2. How does the (i) pole strength and (ii) magnetic moment of each part of a bar magnet Change if it is cut into two equal pieces transverse to its length? (1)
3. Write two advantages of using radial magnetic field in a moving coil galvanometer(1)
4. Two identical balls having equal positive charge q coulombs are suspended by two insulating strings of equal length. What would be the effect on the force when a plastic sheet is inserted between the two? (1)
5. Write two special characteristics of magnanin due to which it is used to make standard resistances? (1)

SECTION B

6. Define the term resolving power of a telescopeHow does it get affected on
   (i) increasing the aperture of the objective lens?
   (ii) increasing the focal length of the objective lens? (2)

   OR

   Two polaroids P_1 and P_2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity I0 is incident on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that its pass axis makes an angle of 30^0 with that of P_1. Determine the intensity of light transmitted through P_1,P_2 and P_3. (2)
7. The relative permeability of a magnetic material is 800. Identify the nature of magnetic material and state its two properties. (2)

P.T.O.

8. Identify the part of the electromagnetic spectrum which is
   (i) suitable for radar systems used in aircraft navigation
   (ii) produced in nuclear reactions
   (iii) produced by bombarding a metal target by high speed electrons
   (iv) produces intense heating effect (2)
9. (a) Write two characteristics of a material used for making permanent magnets.
   (b) Why is the core of an electromagnet made of ferromagnetic materials? (2)
10. The relative permittivity of a medium is 9 and the relative permeability is unity What is the speed of e.m waves in the medium? (2)

SECTION C

11. State the working principle of a potentiometer. Explain with the help of a circuit diagram, how the emfs of two primary cells are compared by using a potentiometer. How can the sensitivity of a potentiometer be increased? (3)
12. An inductor 200 mH, capacitor 500 μF, resistor 10 Ω are connected in series with a 100V, variable frequency a.c source. Calculate the
   (i) Frequency at which the power factor of the circuit is unity.
   (ii) Current amplitude at this frequency.
   (iii) Q- factor. (3)
13. Define an equipotential surface. Draw equipotential surfaces:
   (i) in the case of a single positive point charge and
   (ii) in a constant electric field in z- direction.
   (iii) Why is the equipotential surfaces about a single charge are not equidistant?
   (iv) Can electric field exist tangential to an equipotential surface? Give reason.(3)
14. (a) Deduce an expression for the electric field at a point on the equatorial plane of an electric dipole of length 2a.
   (b) An electric dipole is free to move. What is the action on it, when it is placed in
   (i) an uniform electric field (ii) non uniform electric field (3)
15. (a) Under what conditions will the strength of current in a wire be the same for connections in series and in parallel of identical cells?
   (b) A cylindrical wire is stretched to increase its length by 10% . Calculate the percentage increase in resistance ? (3)

16. (a)A light metal disc on the top of an electromagnet is thrown up as the current is switched on. Why? Give reason. (1)
   (b) A rod of length 'l' is moved horizontally with a uniform velocity 'v' in a direction perpendicular to its length through a region in which a uniform magnetic field is acting vertically downward. Derive the expression for the e.m.f induced across the ends of the rod. (2)

OR

(a) Define the coefficient of mutual induction.
(b) A long solenoid, of length 'l' and radius r_1 is enclosed coaxially within another long solenoid of length l and radius r_2 ($r_2 > r_1$ and $l > r_2$). Deduce the expression for the mutual inductance of this pair of solenoids. (3)

17. A parallel plate capacitor is to be designed with a voltage rating 1kV, using a material of dielectric constant 3 and dielectric strength about 10^7 V/m. For safety, we would like the field never to exceed say 10% of the dielectric strength
   What minimum area of the plates is required to have a capacitance of 50pF? (3)
18. Using Gauss's theorem calculate the electric field due to a uniformly charged

Spherical shell at a point (a) inside the shell
(b) on the shell and
(c) outside the Shell.
Draw a graph showing the variation of electric field with r, for $r < R$ and $r > R$.(3)

19. (i) Write the following radiations in ascending order in respect of their frequencies
X –rays, microwaves, UV rays, radio waves, gamma waves.
(ii) The oscillating electric field of an electromagnetic wave is given by
$E_y = 30 \sin [2 \times 10^{11} t + 300\pi x]$ V/m
(a) Obtain the value of the wavelength of the electromagnetic wave
(b) Write down the expression for the oscillating magnetic field. (3)

20. What is the effect on the interference pattern in a Young's double slit experiment due to each of the following operations:
(a) the screen is moved away from the plane of the slits
(b) the separation between the two slits is halved
(c) the width of the slits are doubled
(d) the source slit is moved closer to the double slit
(e) the light of smaller frequency is used
(f) the apparatus is immersed in water. (3)

21. Using the data given below, state which two of the given lenses will be preferred to construct a (i) telescope and (ii) microscope. Also indicate which is to be used as objective and as eyepiece in each case.

Lenses	Power (P)	Aperture (A)
L_1	6 D	1 cm
L_2	3 D	8 cm
L_3	10 D	1 cm

22. A convex lens made up of glass of refractive index 1.5 is dipped,in turn, in
(a) medium of refractive index 1.65 (b) medium of refractive index 1.33.
(i) Will it behave as a converging or a diverging lens in the two cases?
(ii) How will its focal length change in the two media? (3)

SECTION D

23. One day Chetan's mother developed a severe stomach ache all of a sudden. She was rushed to the doctor who suggested for an immediate endoscopy test and gave an estimate of expenditure for the same. Chetan immediately contacted his class teacher and shared the information with her. The class teacher arranged for the money and rushed to the hospital. On realizing that Chetan belonged to a below average income group family, even the doctor offered concession for the test fee. The test was conducted successfully.
(a) Which principle in optics is made use of in endoscopy?
(b) Briefly explain the values reflected in the action taken by the teacher.
(c)In what way do you appreciate the response of the doctor on the given situation? (4)

SECTION E

24. (a) Derive an expression for the average power consumed in a series LCR circuit connected to an a.c source in which the phase difference between the voltage and

the current in the circuit is ϕ.

(b) Define the quality factor in an a.c. circuit. Why should the quality factor have high value in receiving circuits? Name the factors on which it depends. (5)

OR

(a) With the help of a labelled diagram, describe briefly the underlying principle and working of a step up transformer.

(b) Write any two sources of energy loss in a transformer.

(c) A step up transformer converts a low input voltage into a high output voltage. Does it violate law of conservation of energy? Explain. (5)

25. (a) State Huygen's principle. Using this principle draw a diagram to show how a plane wavefront incident at the interface of the two media gets refracted when it propagates from a rarer to a denser medium. Hence verify Snell's law of refraction.

(b)When monochromatic light travels from a rarer to a denser medium, explain the following, giving reasons:

(i)Is the frequency of reflected and refracted light same as the frequency of incident light?

(ii) Does the decrease in speed imply a reduction in the energy carried by light wave?

OR

(a) (i) Two independent monochromatic sources of light cannot produce a sustained Interference pattern.Give reason.

(ii) Light waves each of amplitude 'a' and frequency, emanating from two coherent light sources superimpose at a point. If the displacements due to these waves is given by $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$ where ϕ is the phase difference between The two, obtain the expression for the resultant intensity at the point.

(b) In Young's double slit experiment, using monochromatic light of wavelength, the Intensity of light at a point on the screen where path difference is K units. Find out the intensity of light at a point where path difference is $\lambda/3$. (5)

26. (a)Derive the expression for torque on a rectangular current carrying loop suspended in a uniform magnetic field.

(b)Explain giving reasons, the basic difference in converting a galvanometer into (i) a voltmeter and (ii) an ammeter.

OR

(a) Draw the magnetic field lines due to a circular loop of area A carrying current I. Show that it acts as a bar magnet of magnetic moment m = IA.

(b) Derive the expression for the magnetic field due to a solenoid of length 2l, radius a having n number of turns per unit length and carrying a steady current I at a point on the axial line, distance r from the centre of the solenoid. How does this expression compare with axial magnetic field due to a bar magnet of magnetic moment m?(5)