

SS

2117

ANNUAL EXAMINATION SYSTEM

PHYSICS (Theory)

(Common for Science and Agriculture Groups)

(English Version)

Time allowed : Three hours

Maximum marks : 70

Note : (i) You must write the subject-code/paper-code **052** in the box provided on the title page of your answer-book.

(ii) Make sure that the answer-book contains 30 pages (including title page) and are properly serialied as soon as you receive it.

(iii) Question/s attempted after leaving blank page/s in the answer-book would not be evaluated.

(iv) Use of unprogrammable calculator/log tables is allowed.

(v) Answers should be to the point and supported by relevant formulas/law/principle/diagram.

(vi) Question No. 1 to 8 will be of one mark each.

(vii) Question No. 9 to 16 will be of two marks each.

(viii) Question No. 17 to 23 will be of four marks each. There will be internal choice in any two questions.

(ix) Question No. 24 to 26 will be of six marks each. There will be internal choice in them.

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

$$C = 3 \times 10^8 \text{ ms}^{-1}, h = 6.6 \times 10^{-34} \text{ Js}, e = 1.6 \times 10^{-19} \text{ C}, \mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1},$$

$$\frac{1}{4\pi \epsilon_0} = 9 \times 10^9 \text{ Am}^2 \text{C}^{-2}.$$

1. Why are alloys used for making standard resistance coils ? 1
2. Define peak value of alternating current. 1
3. How much is the value of energy gap in conductors ? 1
4. A carrier of 200V and 2400 kHz is modulated by 100V, 2000Hz sine wave signal. Find the modulation index. 1
5. Displacement current exists due to a electric field. 1

6. Susceptibility is positive and large for a
- Non-magnetic Substance
 - Ferromagnetic Substance
 - Diamagnetic Substance
 - Paramagnetic Substance 1
7. Does the stopping potential in photoelectric emission depends upon the frequency of incident radiation? (Yes/No) 1
8. Nuclear density is independent of size (radius) of nucleus but increases with increase in mass number. (True/False) 1
9. Give two basic differences between myopia and hypermetropia. 2
10. A copper wire of area of cross-section 5 mm^2 is 2m long and carries a current of 10A. The number density of free electrons is $5 \times 10^{28} \text{ m}^{-3}$. How much time is required by an electron to travel the length of wire? 2
11. Write logical symbol, boolean expression and truth table for AND gate. 2
12. A long straight conductor carrying a current of 15A is placed in an external uniform magnetic field of $4 \times 10^{-4} \text{ T}$ parallel to the current. Find the magnitude of net magnetic field at a point 1.0 cm away from the conductor. 2
13. How do we make the choice of communication channel? 2
14. Rays of red and blue light are incident on a given small angled prism. Which will have larger value of angle of minimum deviation and why? 2
15. Give any four uses of UV rays. 2
16. Calculate the impedance of circuit and current flowing in the circuit, when an alternating voltage of 200V is connected with a LCR series circuit having reactance of C and L as 250Ω and 220Ω respectively and R is 40Ω . 2
17. What is Self induction? Derive an expression for self inductance of a long solenoid. State any two factors on which the value of self inductance of a coil depends. 4 (1,2,1)

18. State Gauss's theorem, using it show that electric field due to a thin infinitely long straight charged wire having uniform charge density λ is inversely proportional to the distance from the line charge. 4 (1,1,2)
19. (a) Name the physical principle of optical fibre.
 (b) In a YDSE, two slits are separated by 5mm. A light of wavelength 5500\AA falls on the slits. The distance of screen is 2m from the plane of the slits. Calculate the separation between 10th bright fringe and 3rd dark fringe with respect to central maxima. 1,3
- or
- (a) Define Brewster's law of polarisation.
 (b) Find the change in focal length of a convex lens having power + 5D made up of glass of refractive index 1.50 is immersed in a liquid of refractive index 1.33. 1,3
20. State the laws of Photoelectric emission. 4
21. Explain Rutherford's model of an atom. What are its limitations? 4
22. (a) Draw the circuit diagram of pn-junction diode as a full wave rectifier.
 (b) In a CE transistor amplifier voltage across the collector is 2V. If current gain of transistor is 100. Find (i) input voltage (ii) base current. (iii) power gain. Given values of base and collector resistances are $1\text{ k}\Omega$ and $2\text{ k}\Omega$ respectively. 1,3
- or
- (a) Draw the circuit diagram of zener diode as a voltage regulator.
 (b) A semiconductor of $16 \times 10^{12}\text{ cm}^{-3}$ and a hole concentration of $10 \times 10^{12}\text{ cm}^{-3}$. Is the semiconductor n-type or p-type? What will be the resistivity of the semi-conductor if electron mobility is $20 \times 10^3\text{ cm}^2\text{ V}^{-1}\text{ s}^{-1}$ and hole mobility is $1 \times 10^2\text{ cm}^2\text{ V}^{-1}\text{ s}^{-1}$. 1,3
23. State Kirchhoff's second law (loop rule) and using it derive the balance condition of wheatstone bridge. 1,3
24. (a) What is the essential condition for diffraction of light to occur? 1
 (b) State Huygen's Principle of wave theory and prove laws of refraction of the basis of wave theory of light. 2,3

or

(a) A ray of light is travelling from air to glass. How will the following be affected :

(i) Energy of wave

(ii) Frequency of wave.

 $\frac{1}{2}, \frac{1}{2}$

(b) With the help of suitable ray diagram explain construction and working of astronomical telescope. Deduce the expression for magnifying power when the final image is formed at least distance of distinct vision.

2,1,1,1

25. (a) Find the absolute permittivity of mica, if its relative permittivity is 8.

1

(b) Define capacitance and its SI unit. Derive an expression for the capacitance of a parallel plate capacitor having dielectric slab between its plates in terms of dielectric constant of the slab.

1,1,3

or

(a) What is the magnitude of electric field required to just balance a liquid droplet of mass 2×10^{-9} kg and charge 9.8×10^{-8} μC ?

1

(b) What is meant by electric potential energy of a system of charges ? Deduce expression for potential energy of two point charges and three point charges and hence generalise the result for N point charges.

1,1½,1½,1

26. (a) Which physical quantity has the unit Wb m^{-2} ? Is it a scalar or vector quantity ?

1

(b) Define equatorial line of a bar magnet. Derive an expression for the magnetic field intensity at a point on equatorial line of a bar magnet. Also give the direction of magnetic field intensity in reference to the direction of its magnetic dipole moment.

1,3,1

or

(a) How will the angle of dip vary when one moves from a place of minimum acceleration due to gravity to a place of maximum acceleration due to gravity on the surface of earth ?

1

(b) Describe the principle, construction, theory and working of moving coil galvanometer with the help of suitable diagram. Define its figure of merit.

1,1,1,1