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DAY – 06 SEAT NUMBER | | | | | | |

2025	II 17	1100	J-287	(E)

PHYSICS (54)

Time : 3 Hrs. **(8 Pages)** **Max. Marks : 70**

Genera lInstructions :

*The question paper is divided into **four** sections :*

(1) ***Section A** :* *Q. No. **1** contains **Ten multiple choice type** of questions carrying **One mark** each.*

*Q. No. **2** contains **Eight very short answer type** of questions carrying **One mark** each.*

(2) ***Section B** :* *Q. No. **3** to Q. No. **14** contain **Twelve short answer** type of questions carrying **Two marks** each. (Attempt **any Eight**).*

(3) ***Section C** :* *Q. No. **15** to Q. No. **26** contain **Twelve short answer** type of questions carrying **Three marks** each. (Attempt **any Eight**).*

(4) ***Section D** :* *Q. No. **27** to Q. No. **31** contain **Five long answer** type of questions carrying **Four marks** each.(Attempt **any Three**).*

(5) *Use of the log table is allowed. Use of calculator is **not** allowed.*

(6) *Figures to the right indicate full marks.*

(7) *For multiple choice type questions, only the first attempt will be considered for evaluation.*

(8) Physical Constants

(i) h = 6.63 × 10–34 Js

(ii) c = 3 × 108 m/s

(iii) = 3.142

(iv) g = 9.8 m/s2

(v) 0= 8.85 × 10–12 C2/Nm2

(vi) μ_0 = 4 ×10–7 Wb/A-m

(vii) = 5.67 × 10–8 W/m2K4

(viii) 1 atm = 1.013 × 105 N/m2

(ix) R = 8.319 J/mol–k

SECTION – A

Q. 1. Select and write the correct answers for the following multiple choice type of questions : [10]

(i) "If two systems are each in thermal equilibrium with a third system, they are also in thermal equilibrium with each other." This statement refers to :

(a) zeroth law of thermodynamics
(b) first law of thermodynamics
(c) second law of thermodynamics
(d) Carnot's law

(ii) In Bernoulli's theorem, which of the following is constant?

(a) Linear momentum (b) Angular momentum
(c) Mass (d) Energy

(iii) Which of the following materials belongs to diathermanous substance?

(a) wood (b) iron
(c) glass (d) copper

(iv) Electric potential 'V' at a distance 'r' from a point charge is directly proportional to _____.

(a) r (b) r2
(c) $1/r$ (d) $1/r^2$

(v) Which of the following equations gives correct expression for the internal resistance of a cell by using potentiometer?

(a) $r = R\left(\frac{V}{E} - 1\right)$ (b) $r = R\left(1 - \frac{E}{V}\right)$

(c) $r = R\left(1 - \frac{V}{E}\right)$ (d) $r = R\left(\frac{E}{V} - 1\right)$

(vi) An electron, a proton, an -particle and a hydrogen atom are moving with the same kinetic energy. The associated de-Broglie wavelength will be longest for

(a) proton (b) electron
(c) hydrogen atom (d) -particle

(vii) The gate which produces high output, when its both inputs are high is –

(a) X-OR gate (b) AND gate
(c) NAND gate (d) NOR gate

(viii) The power rating of a ceiling fan rotating with a constant torque of 2 Nm with an angular speed of 2 rad/s will be _____.

(a) W (b) 2 W

(c) 3 W (d) 4 W

(ix) A string of length 2 m is vibrating with 2 loops. The distance between its node and adjacent antinode is _____.

(a) 0.5 m (b) 1.0 m

(c) 1.5 m (d) 2.0 m

(x) A transformer increases an alternating e.m.f. from 220V to 880V. If primary coil has 1000 turns, the number of turns in the secondary coil are _____.

(a) 1000 (b) 2000

(c) 3000 (d) 4000

Q. 2. Answer the following questions : [8]

(i) At what temperature the surface tension of a liquid becomes zero?

(ii) Define self inductance.

(iii) What is the work done by an external uniform magnetic field perpendicular to the velocity of a moving charge?

(iv) What do you mean by a thermodynamic system?

(v) What is value of B called, when H = 0 is in the hysteresis loop?

(vi) State the formula for angle of banking. Calculate the

(vii) electric field intensity at a point just near the surface of a charged plane sheet, measured from its mid-point.

[= 8.85 μC/m2]

(viii) Find kinetic energy of 1 litre of an ideal gas at S.T.P.

SECTION – B

Attempt any EIGHT questions of the following : [16]

Q. 3. Explain harmonics and overtones. Using Newton's law of

Q. 4. viscosity for streamline flow, derive an expression for coefficient of viscosity.

Q. 5. State the formula for magnetic induction produced by a current in a circular arc of a wire. Hence find the magnetic induction at the centre of a current carrying circular loop.

Q. 6. State and prove the law of conservation of angular

Q. 7. momentum. State any four advantages of light emitting

Q. 8. diode (LED). Calculate the energy radiated in one minute by a perfectly black body of surface area 200 cm2 when it is maintained at

Q. 9. 12 7° C. Two coils having self inductances 60 mH each, are coupled with each other. If the coefficient of coupling is 0.75, calculate the mutual inductance between them.

Q. 10. In a series LCR circuit, if resistance, inductive reactance and capacitive reactance are 3, 8 and 4 respectively, calculate phase difference between voltage and current.

Q. 11. State the advantages of a potentiometer over a voltmeter.

Q. 12. Draw a neat and labelled circuit diagram for a full wave rectifier.

Q. 13. A body of mass 0.8 kg performs linear S.H.M. It experiences a restoring force of 0.4N, when its displacement from mean position is 4 cm. Determine Force constant and Period of S.H.M.

Q. 14. A gas of 0.5 mole at 300 K expands isothermally from an initial volume of 2.0 litre to a final volume of 6.0 litre. What is the work done by gas?

SECTION – C

Attempt any EIGHT questions of the following : [24]

Q. 15. Obtain an expression for the period of a bar magnet vibrating in a uniform magnetic field, performing S.H.M.

Q. 16. In a thermodynamic system, define –

(a) Mechanical equilibrium
(b) Chemical equilibrium and
(c) Thermal equilibrium

Q. 17. What is Brewster's law? Derive the formula for Brewster's angl e.

Q. 18. Derive an expression for law of radioactive decay. Define one becquerel (Bq).

Q. 19. State and prove Kirchhoff 's law of heat radiation.

Q. 20. Obtain an expression for practical determination of end correction –

(i) for a pipe open at both ends and

(ii) for a pipe closed at one end.

Q. 21. A conducting bar is rotating with constant angular speed around a pivot at one end in a uniform magnetic field perpendicular to its plane of rotation. Obtain an expression for the rotational e.m.f. induced between the ends of the bar.

Q. 22. An electron in hydrogen atom stays in its second orbit for 10–8 s. How many revolutions will it make around the nucleus in that time?

[Given : e = 1.6 × 10–19 C, m = 9.1 × 10–31 kg]

Q. 23. A flywheel of a motor has mass 100 kg and radius 1.5 m. The motor develops a constant torque of 2000 Nm. The flywheel starts rotating from rest. Calculate the work done during the first 4 revolutions.

Q. 24. A galvanometer has a resistance of 50 and a current of 2 mA is needed for its full scale deflection. Calculate resistance required to convert it,

(i) into an ammeter of 0.5 A range.

(ii) into a voltmeter of 10 V range.

Q. 25. Diameter of a water drop is 0.6 mm. Calculate the pressure inside a liquid drop.

(T = 72 dyne/cm, atmospheric pressure = 1.013 × 105 N/m2)

Q. 26. A solenoid of length m and 5 cm in diameter has a winding of 1000 turns and carries a current of 5A. Calculate the magnetic field at its centre along the axis.

SECTION – D

Attempt any THREE questions of the following : [12]

Q. 27. What is Ferromagnetism? Explain it on the basis of domain theory.

Q. 28. Obtain an expression for average power dissipated in a series LCR circuit.

Distinguish between interference and diffraction of light.

Q. 29. A double slit arrangement produces interference fringes for sodium light of wavelength 589 nm, that are 0.20 degree apart.

What is the angular fringe separation if the entire arrangement is immersed in water?

(R.I. of water = 1.33)

Q. 30. State Einstein's photoelectric equation and mention physical significance of each term involved in it.

The wavelength of incident light is 4000Å. Calculate the energy of incident photon.

Q. 31. State any four uses of Van de Graaff generator.

In a parallel plate air capacitor, intensity of electric field is changing at the rate of 2 × 1011 V/ms. If area of each plate is 20 cm2, calculate the displacement current.